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Ford Environmental Steward Luis Lara
wants people to see the rain forest,
but more than that, he wants
a rain forest left for people to see.

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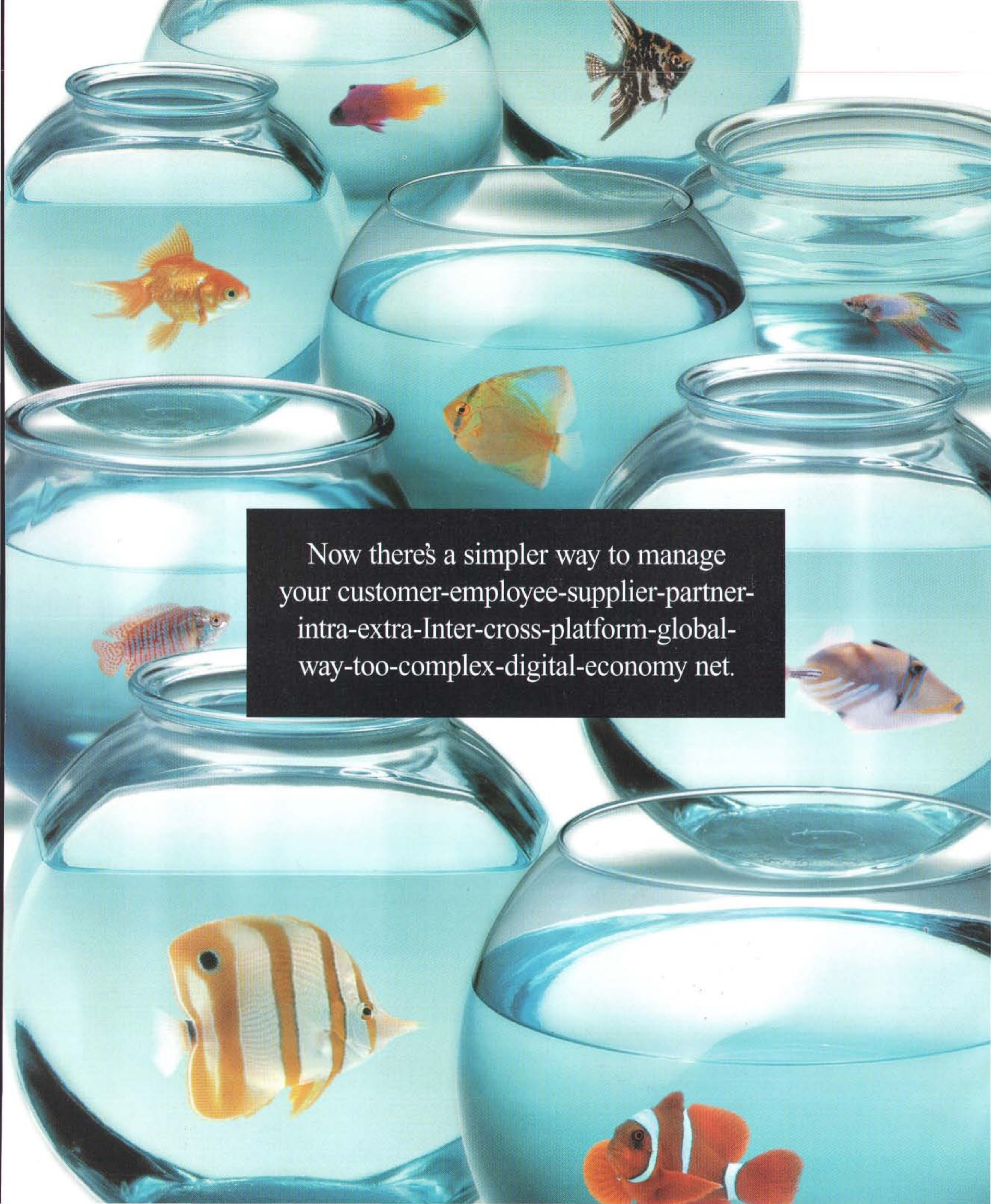
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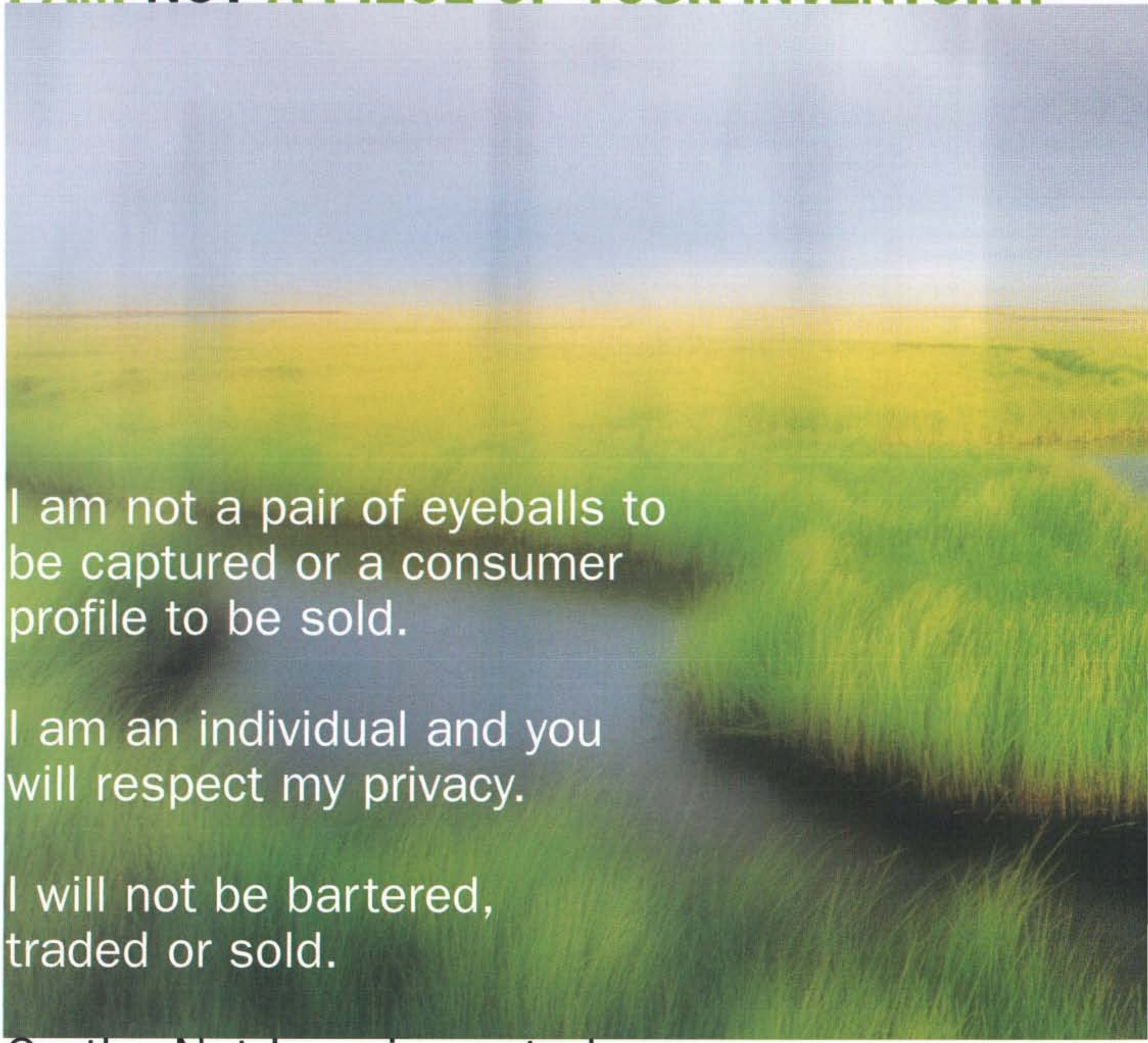

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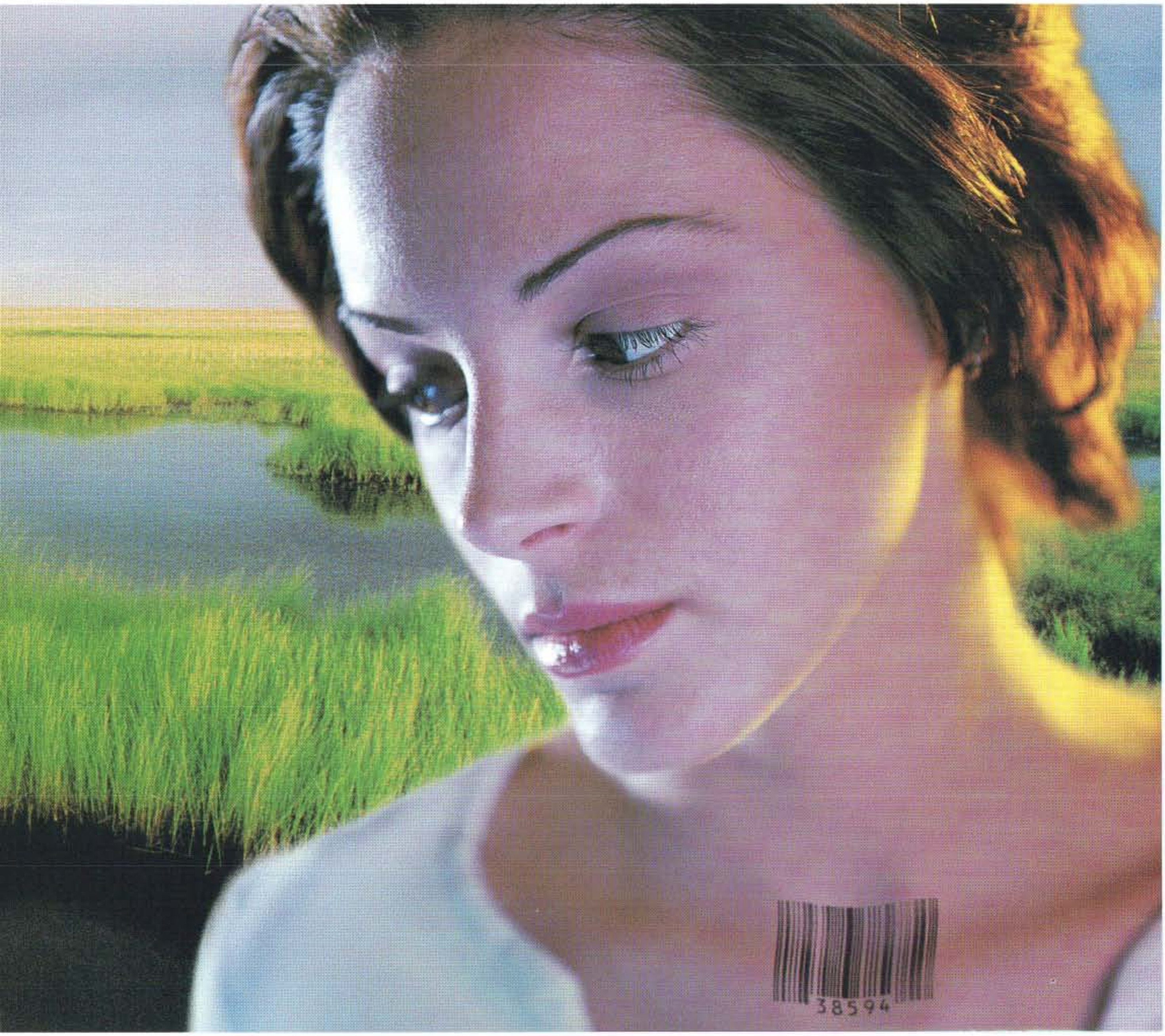

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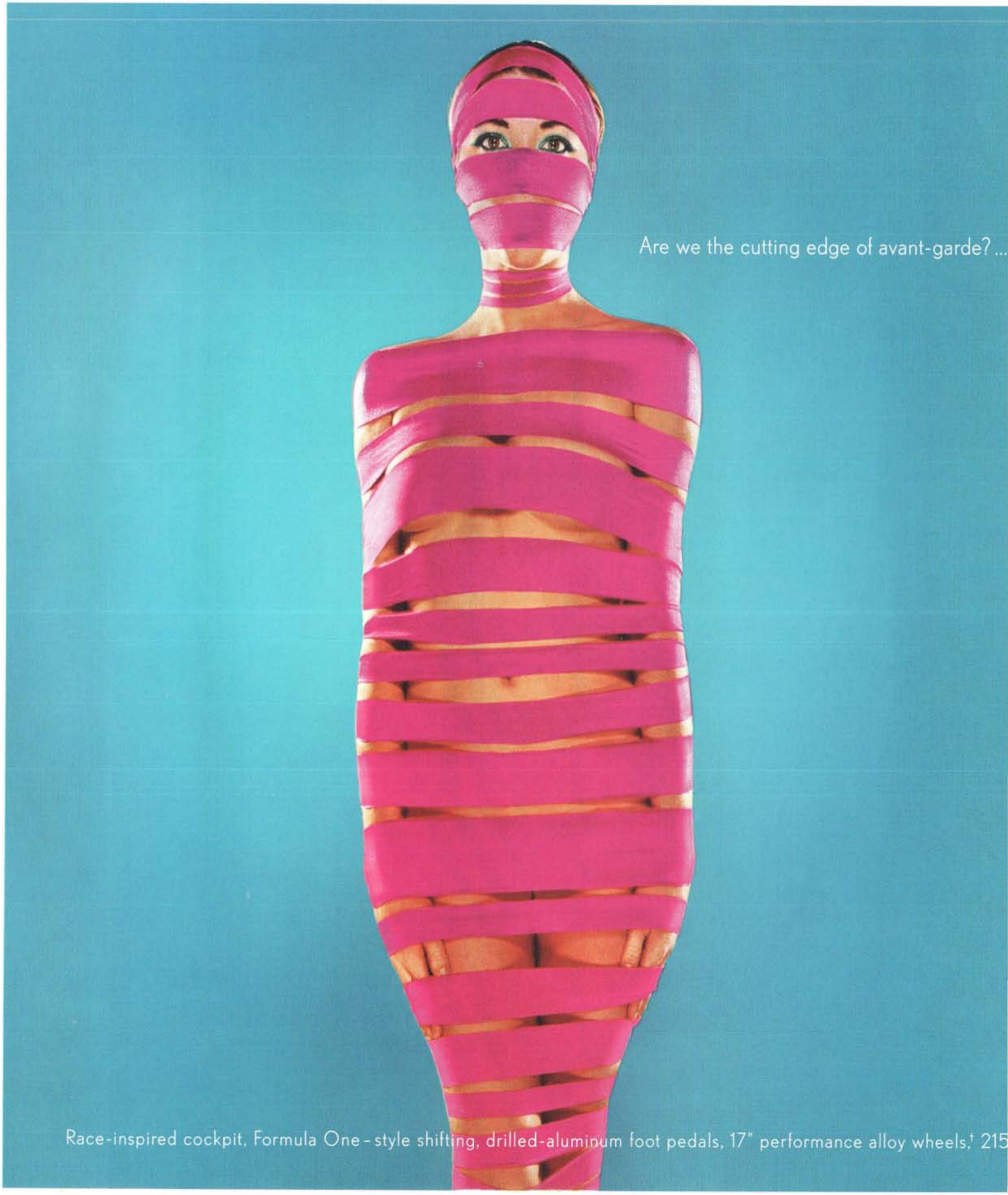
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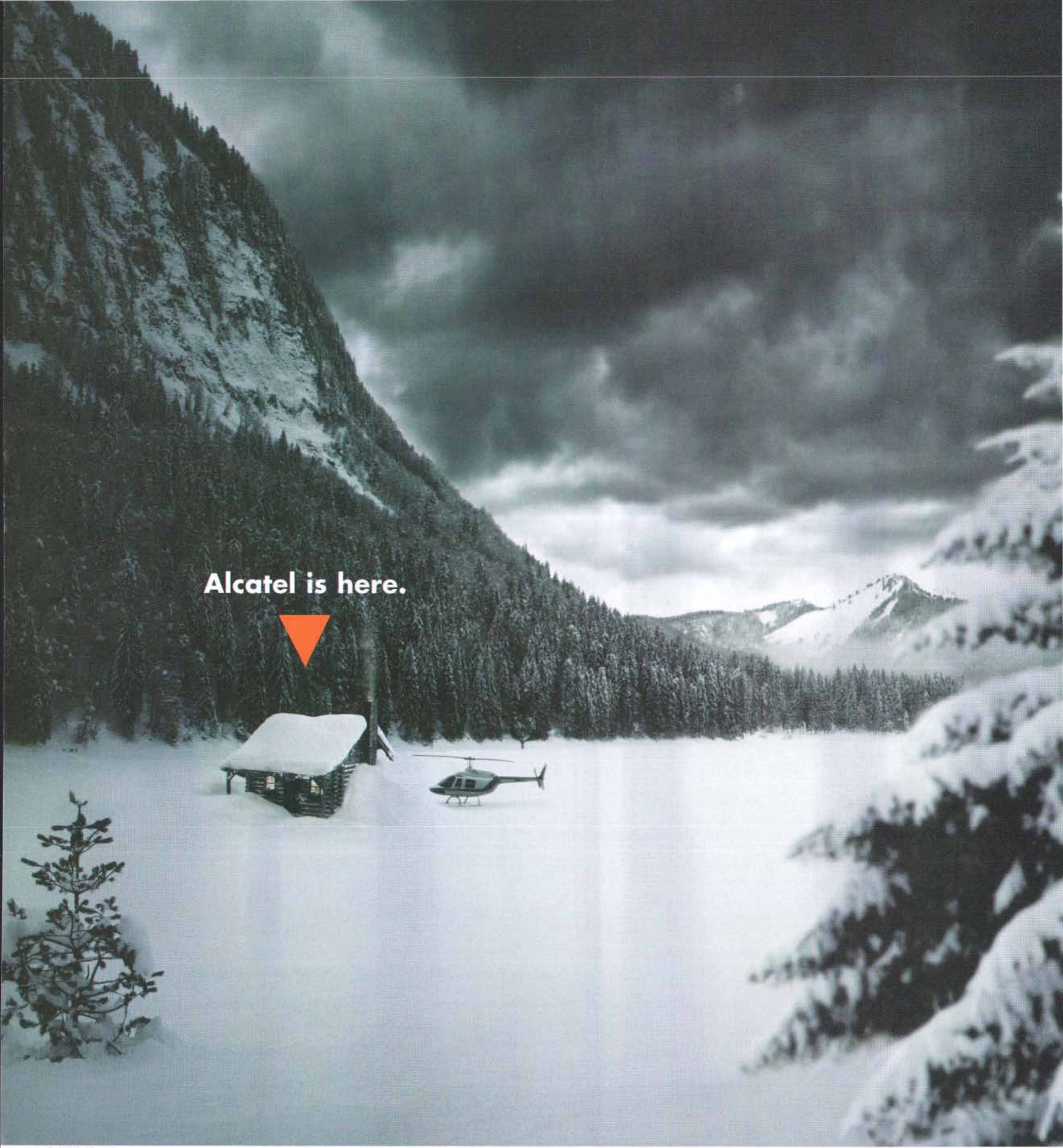

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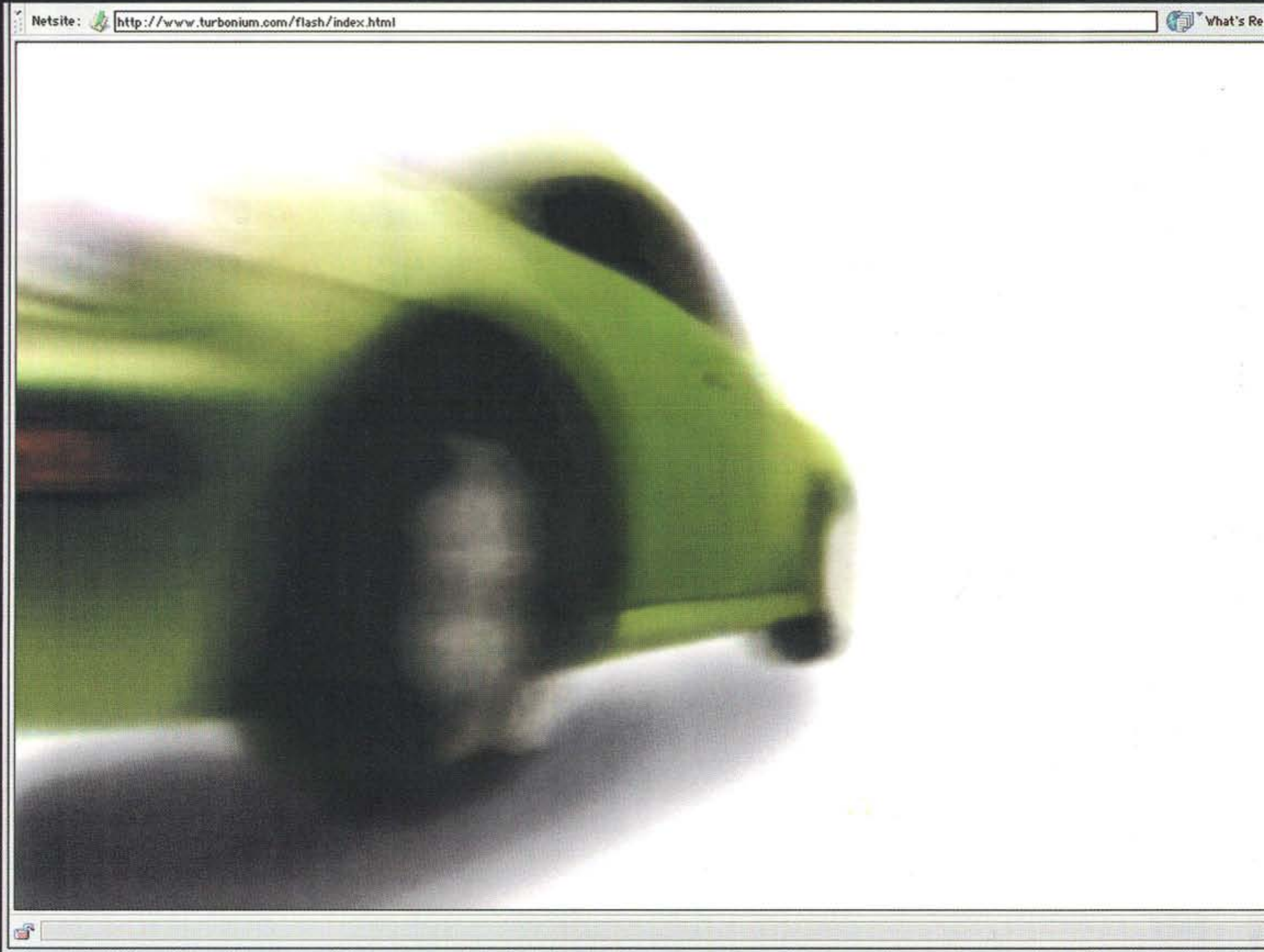

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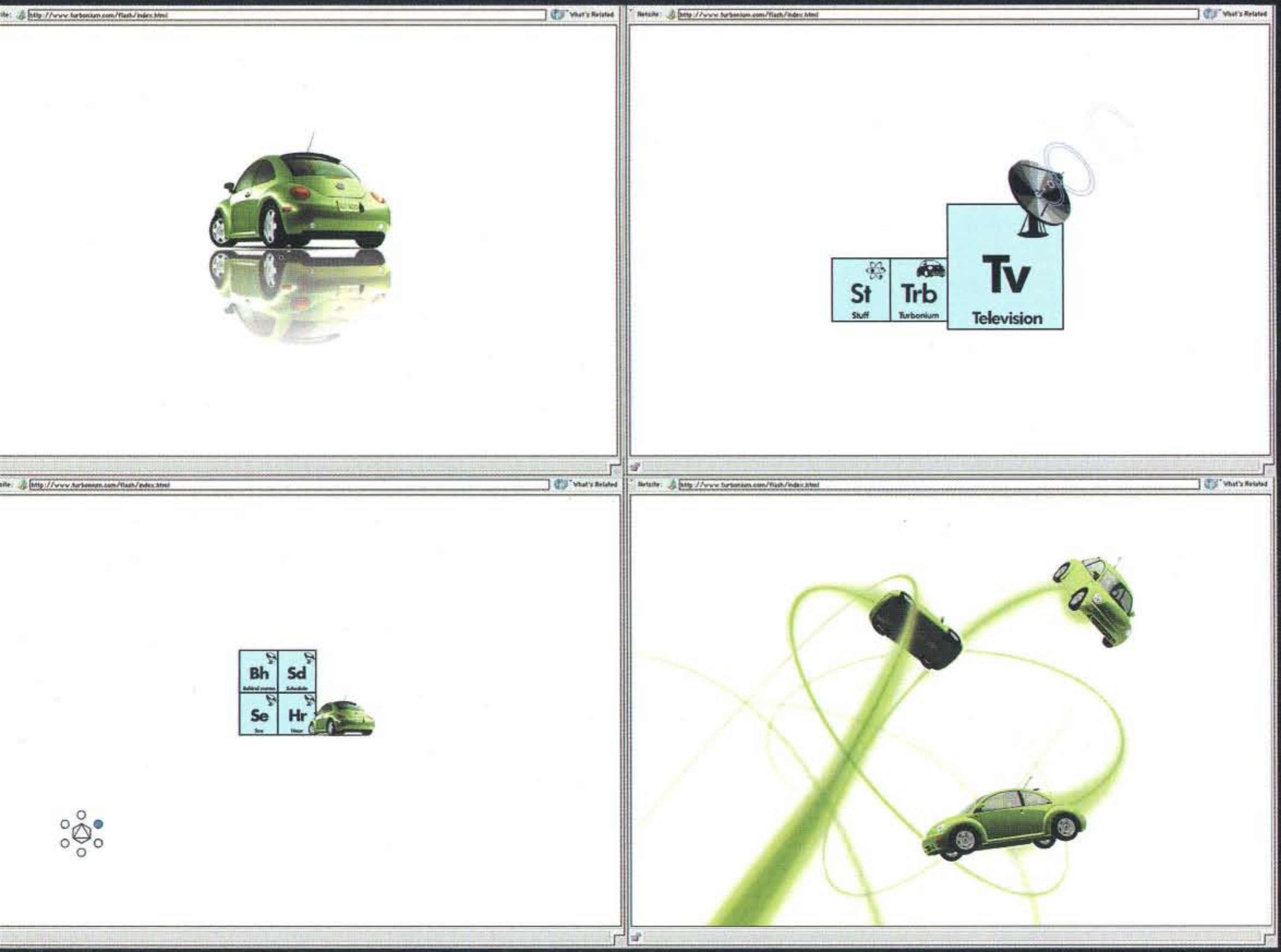

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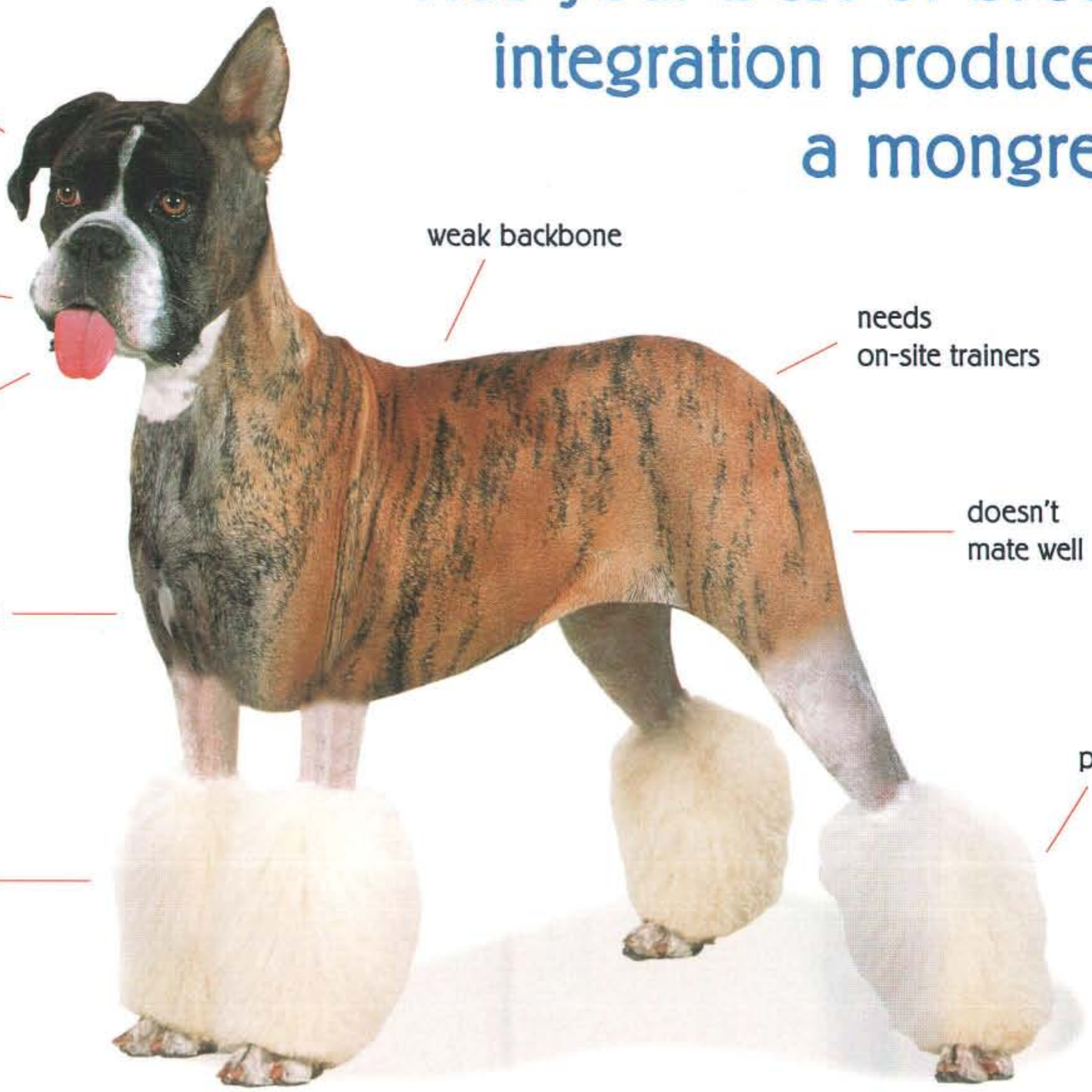
Has your best-of-breed integration produced a mongrel?



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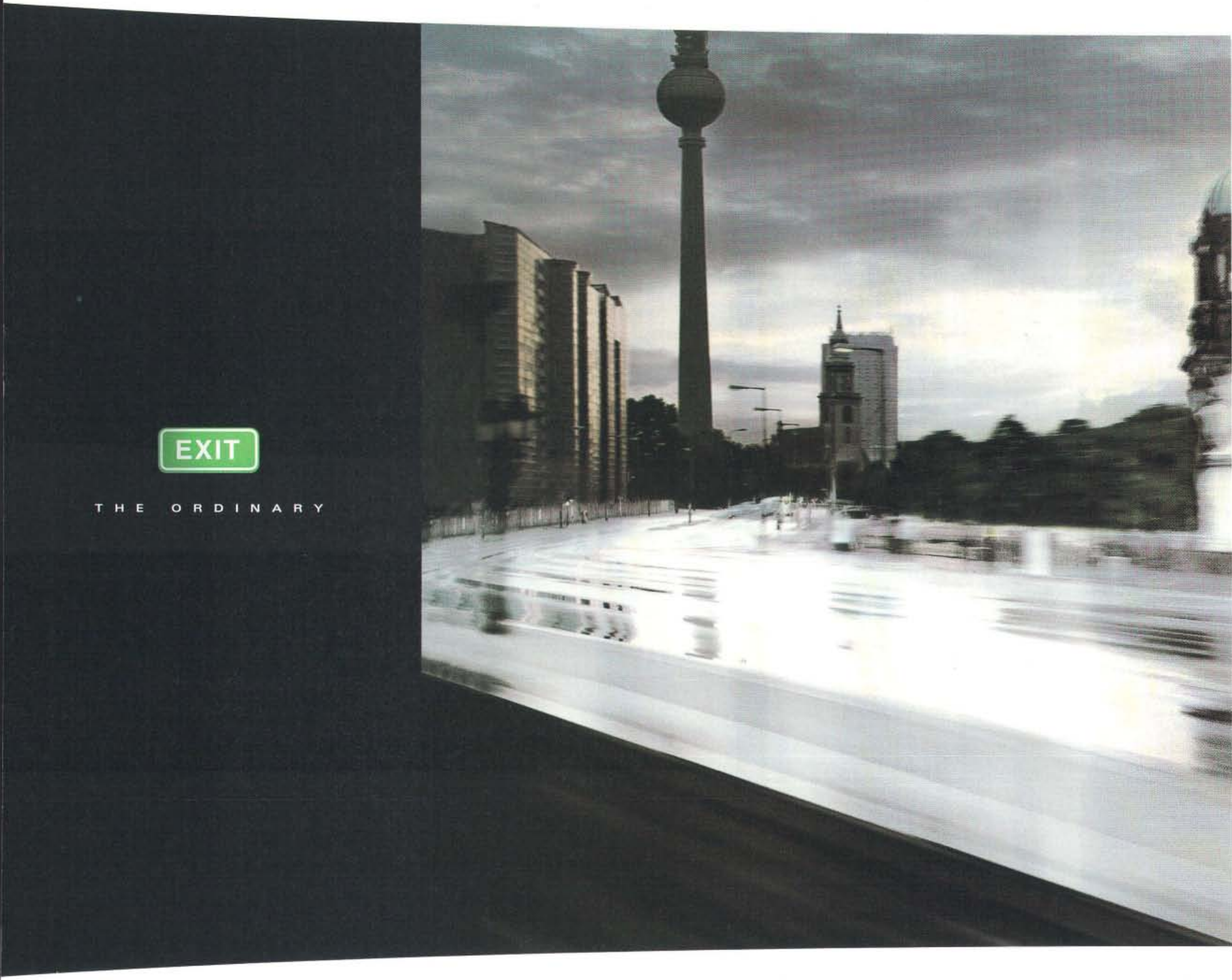

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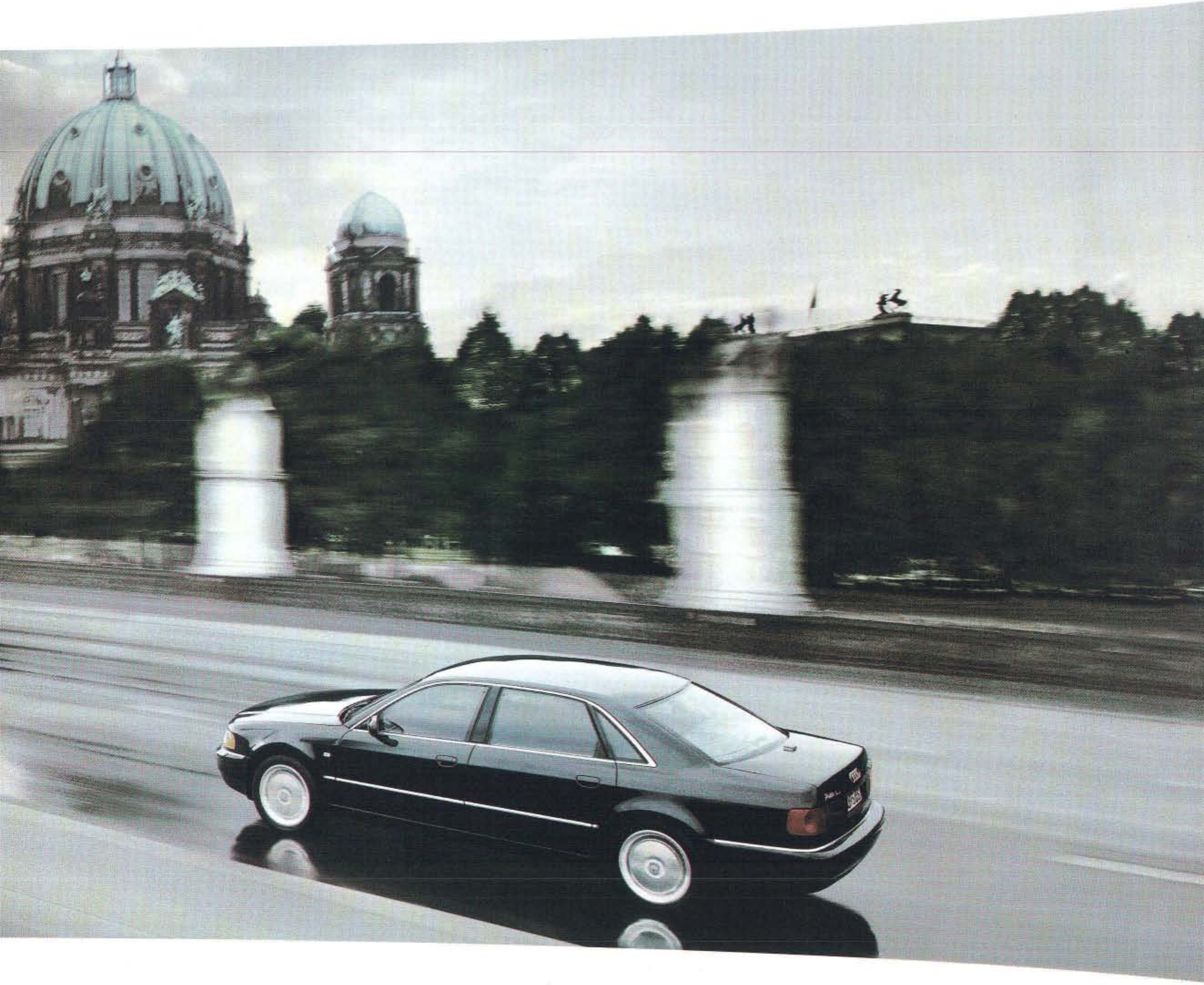

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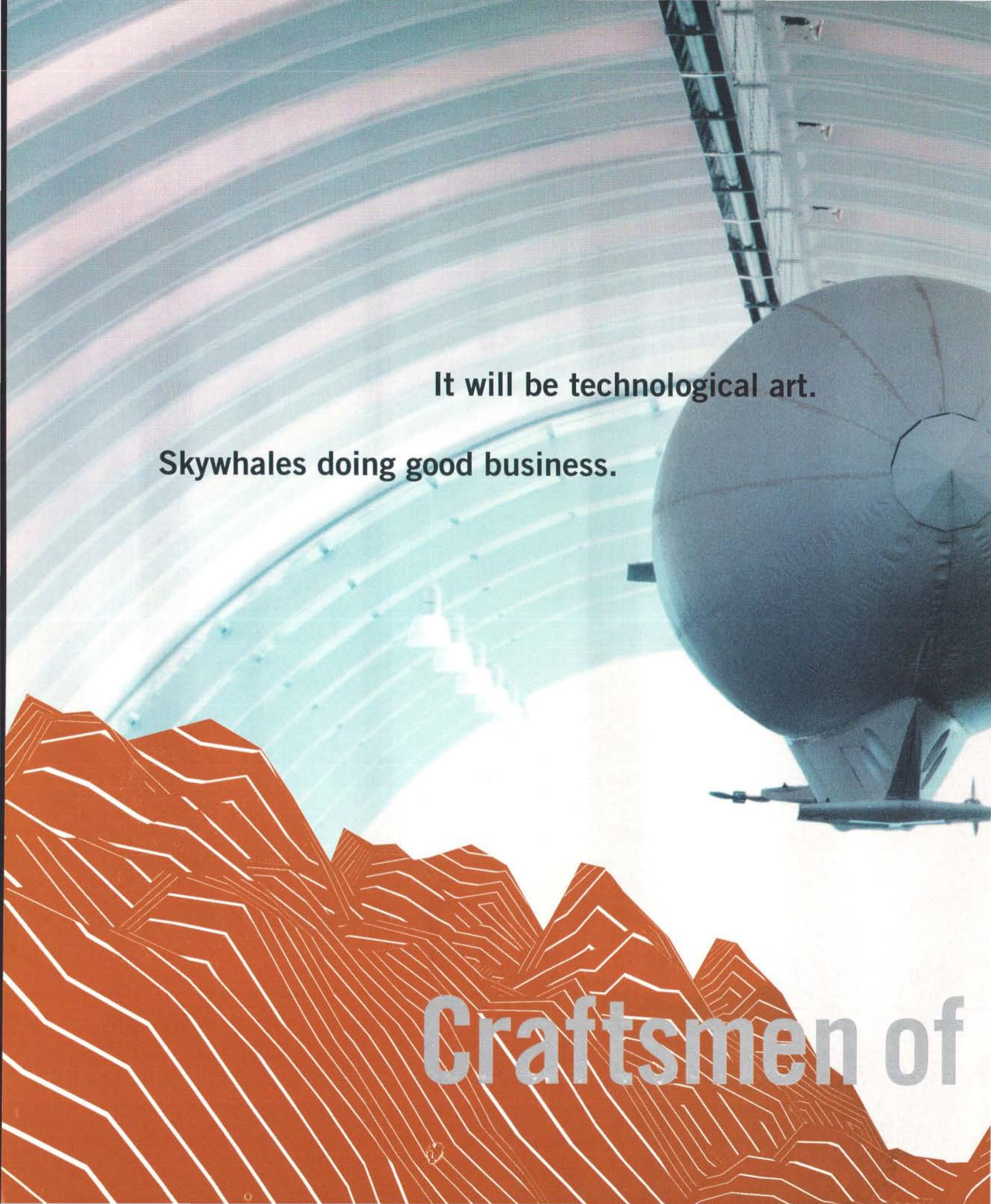

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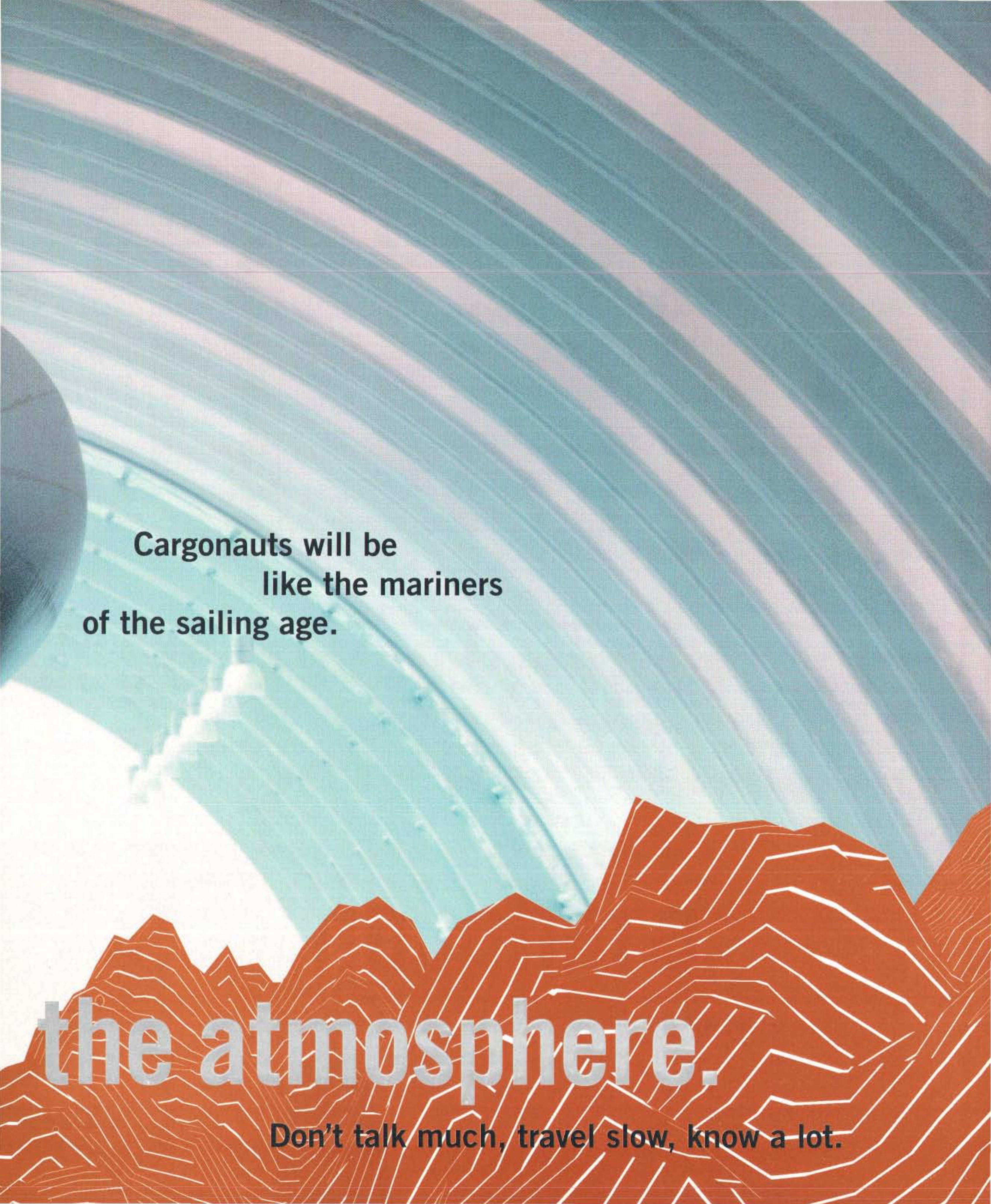

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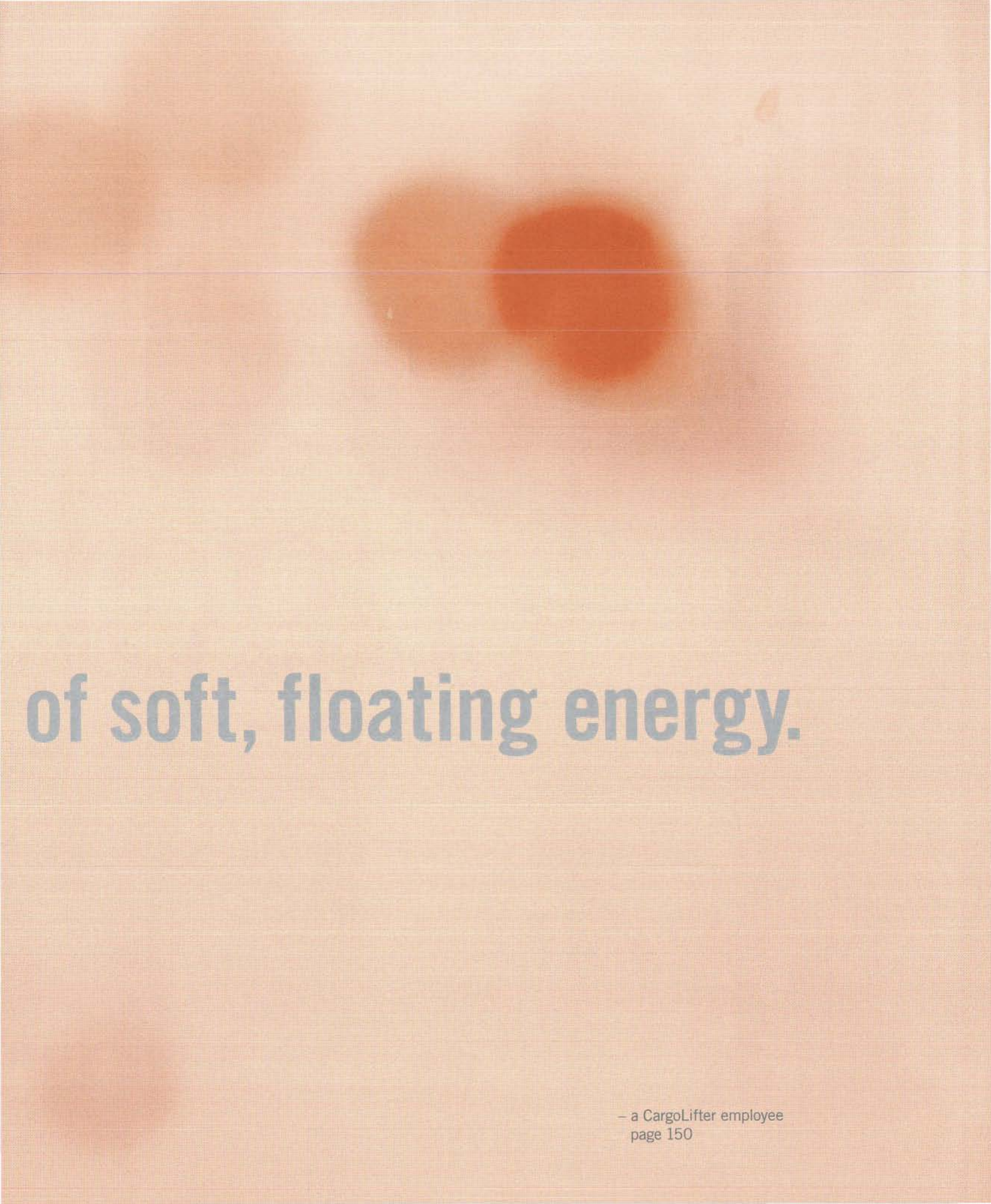

of soft, floating energy.

– a CargoLifter employee
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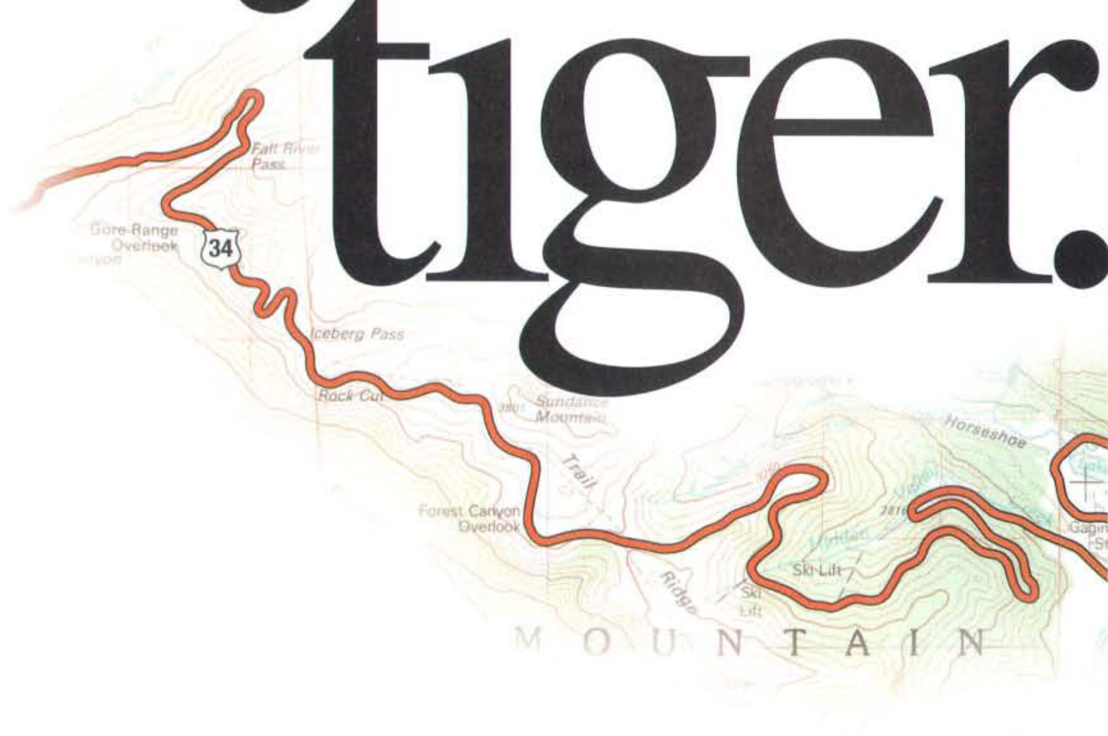
Cyber-tiger.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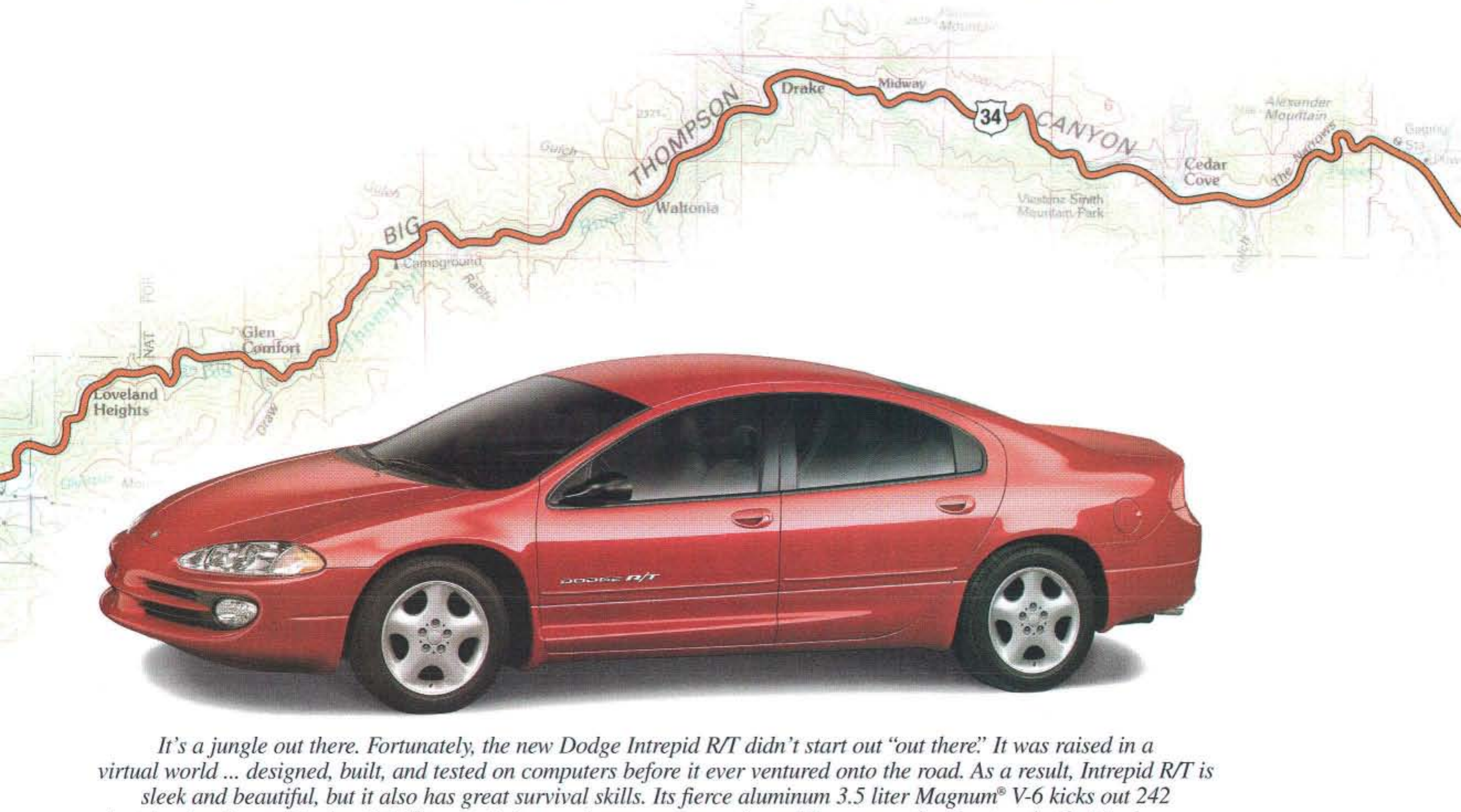

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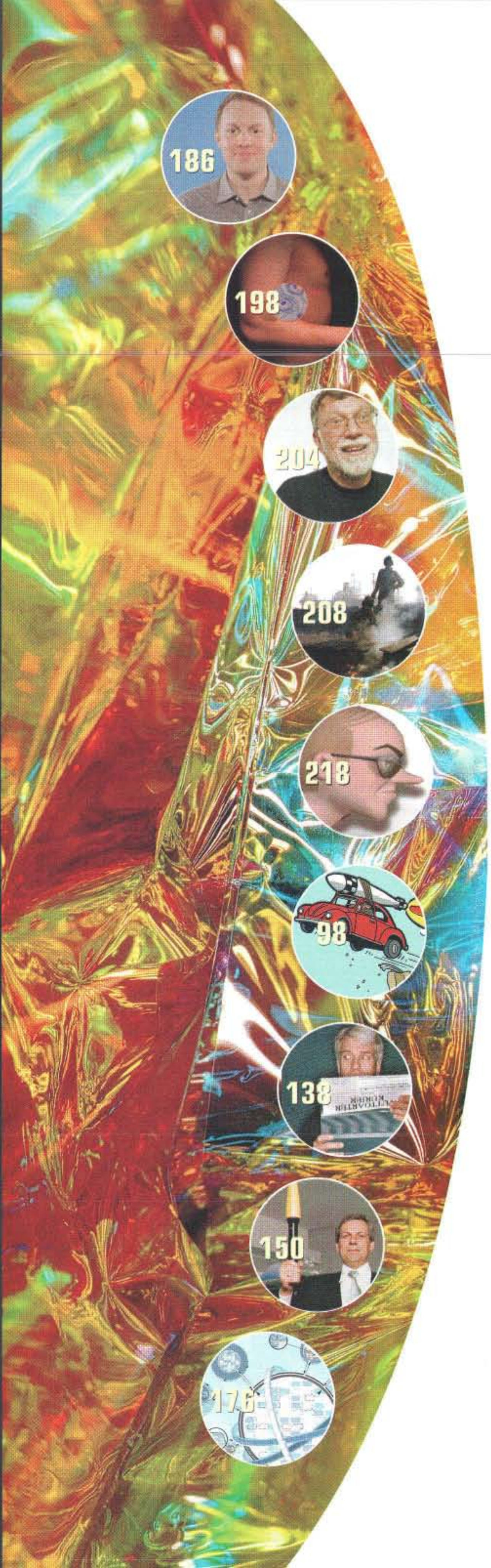

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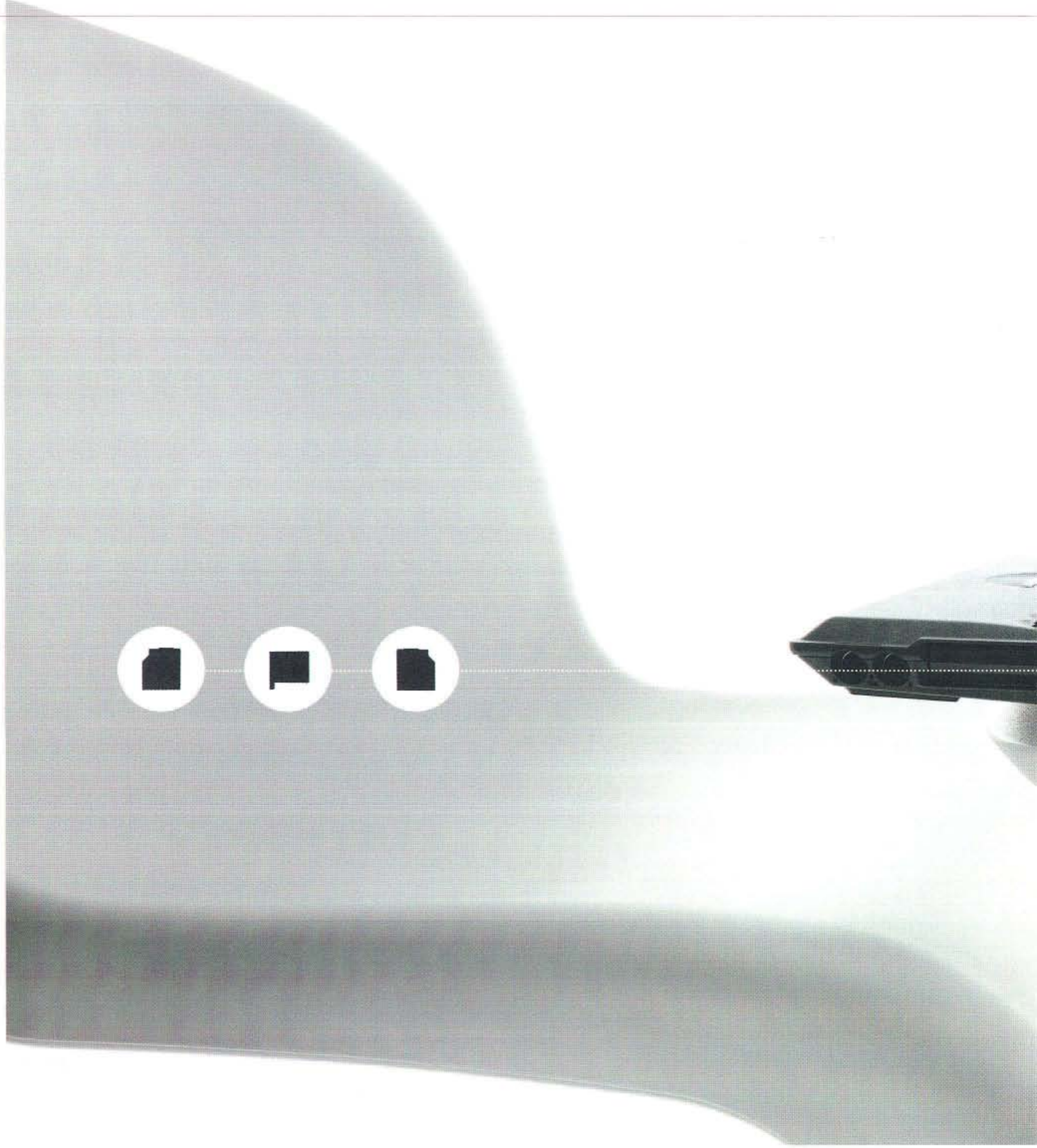

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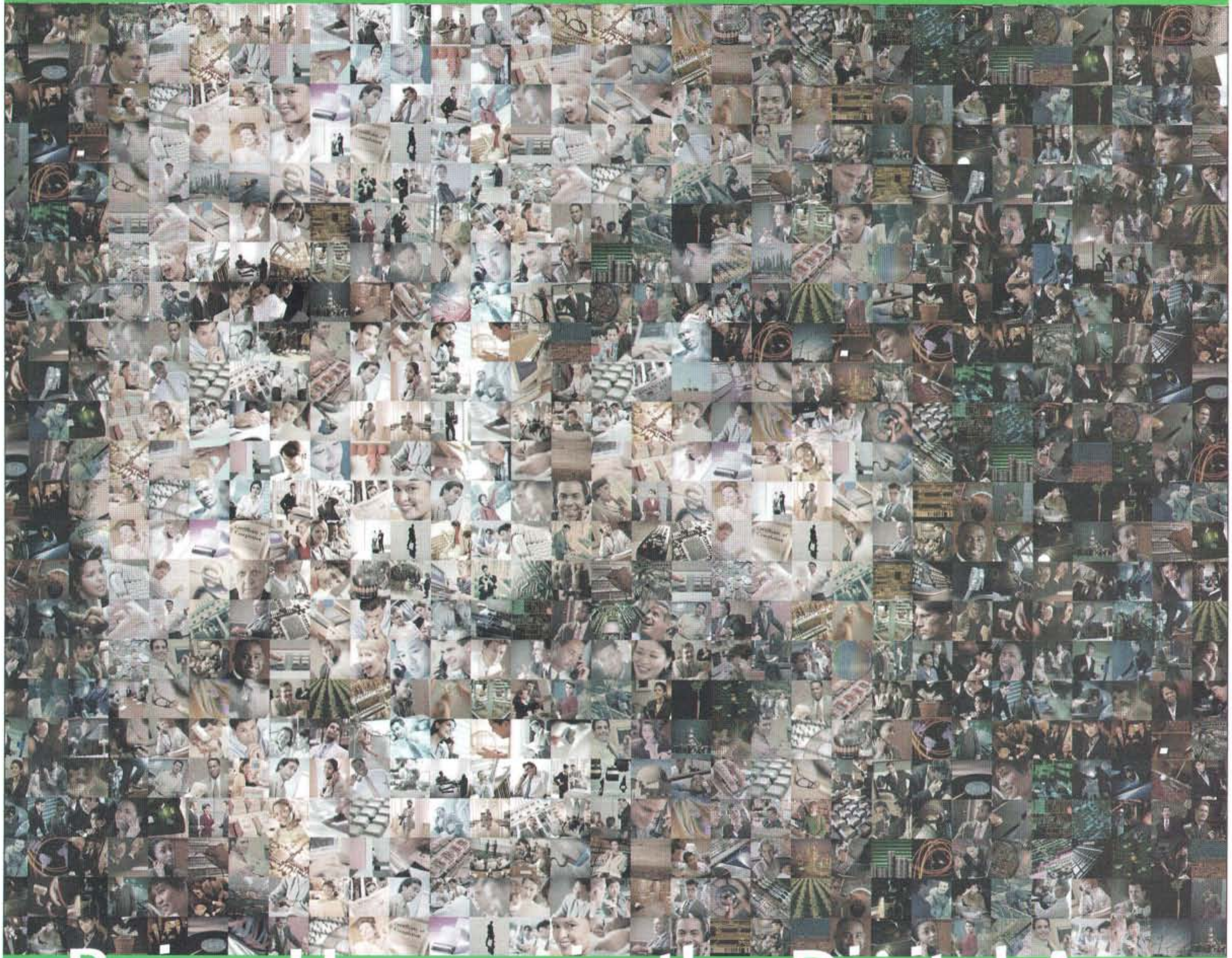

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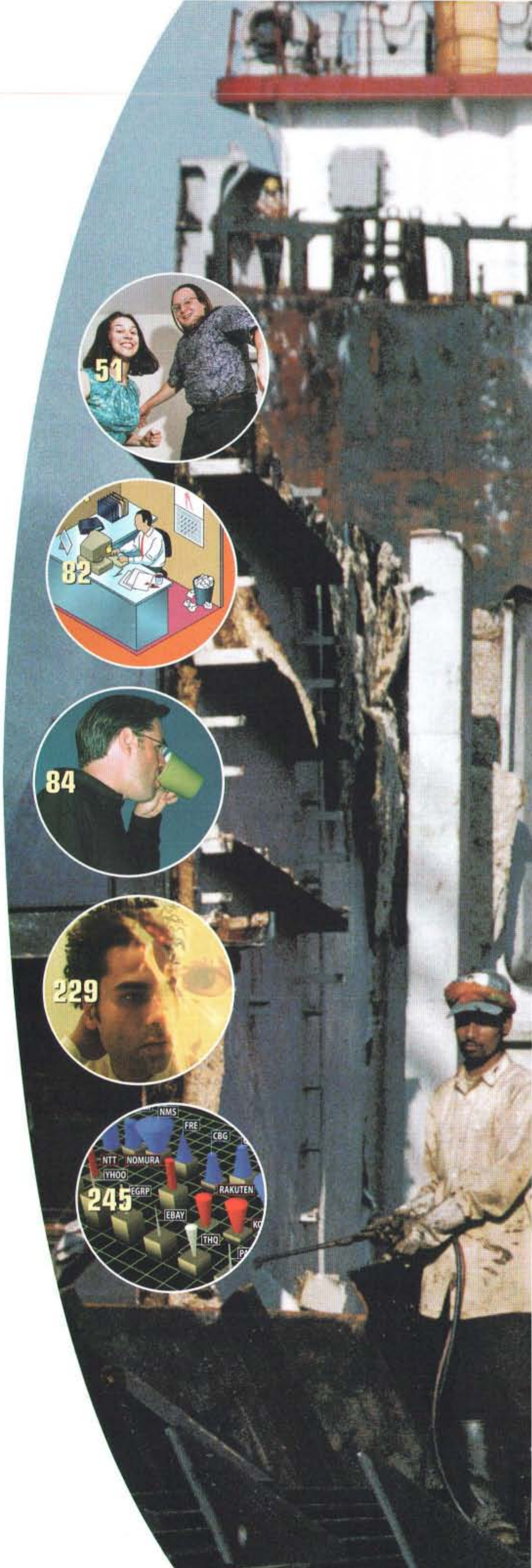

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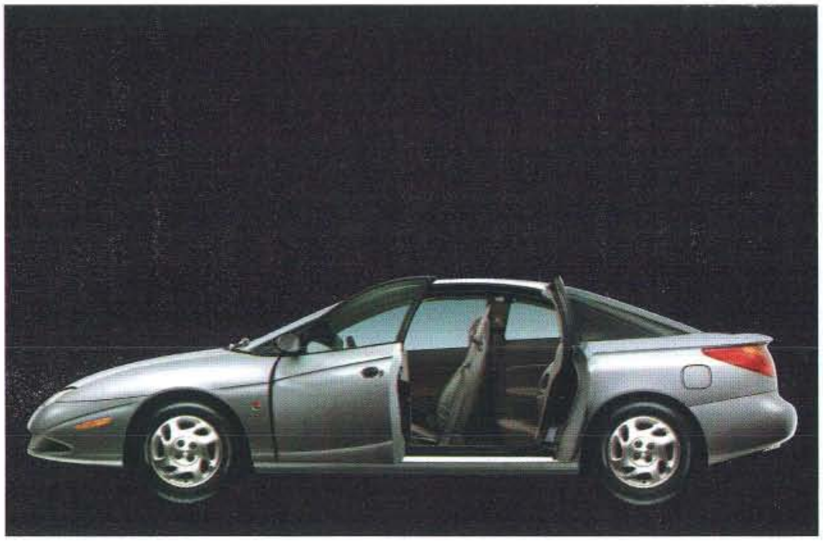

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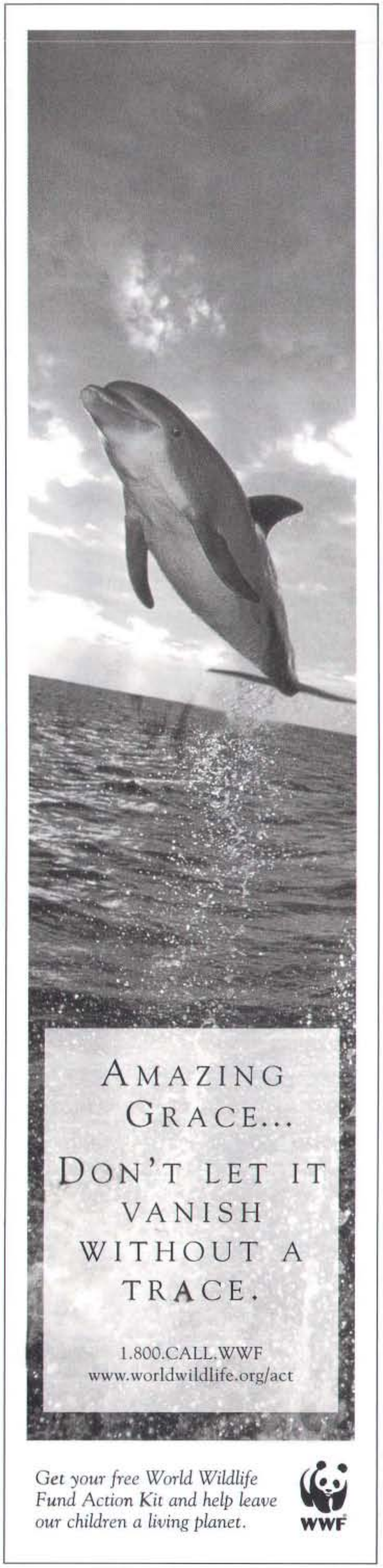
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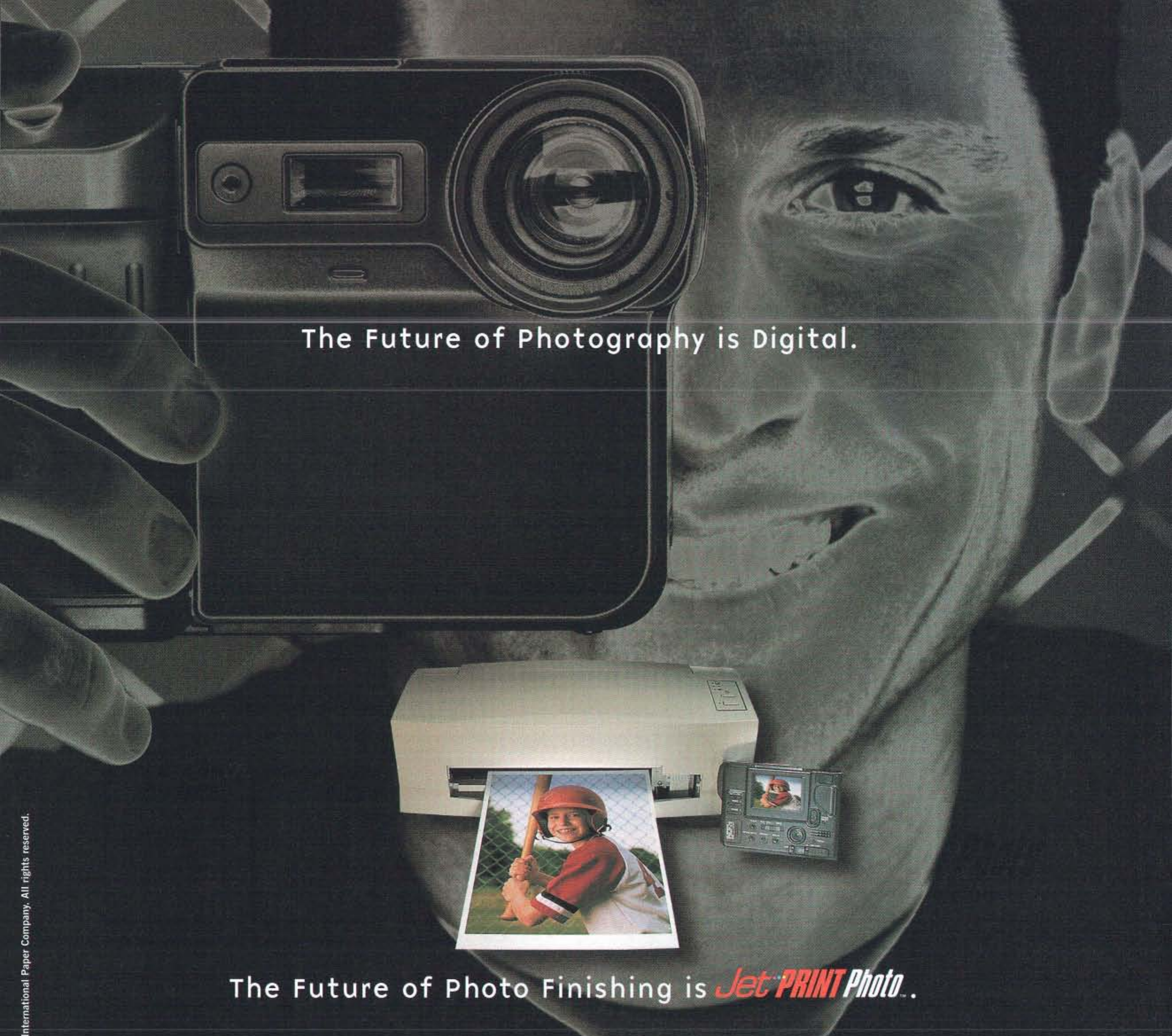
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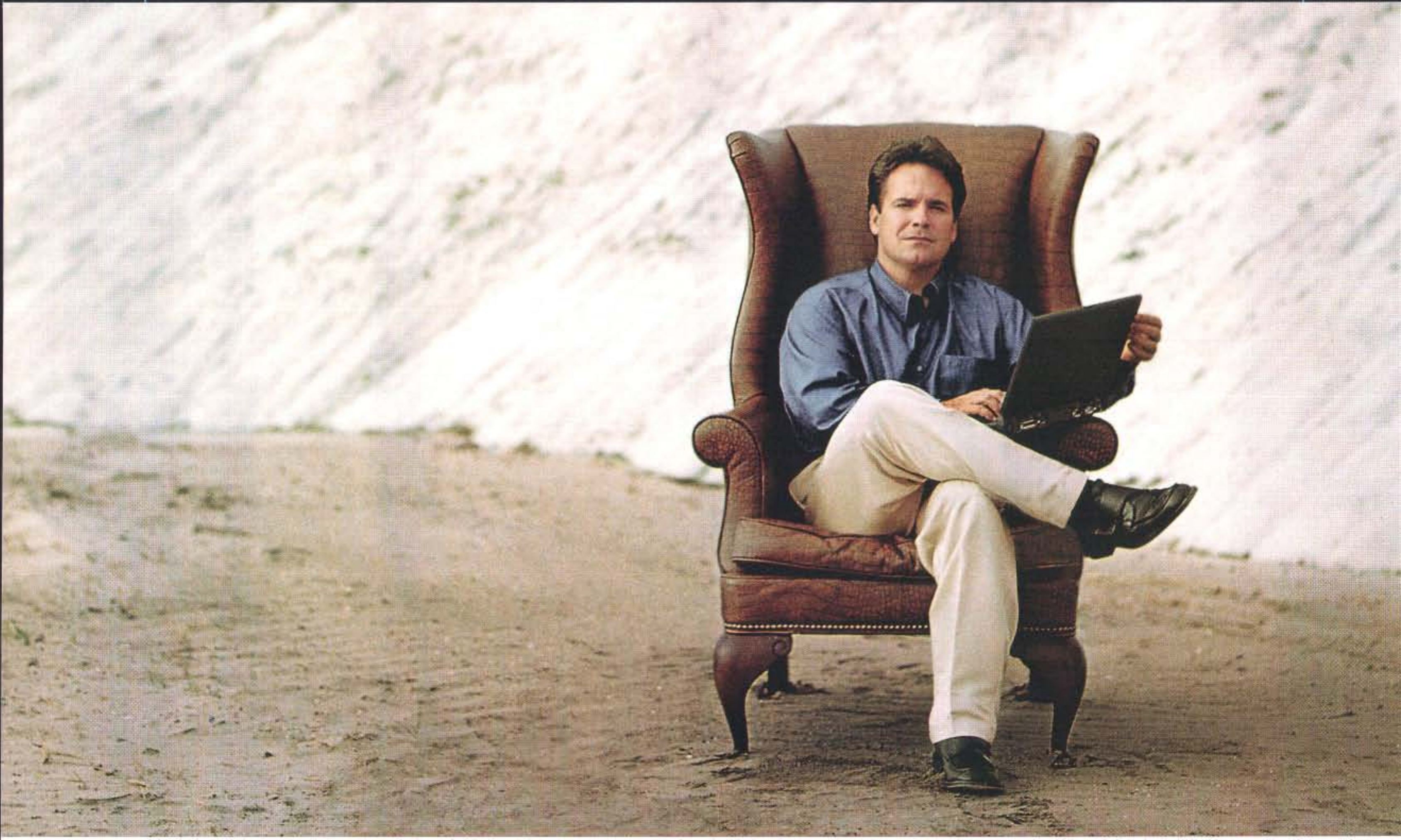

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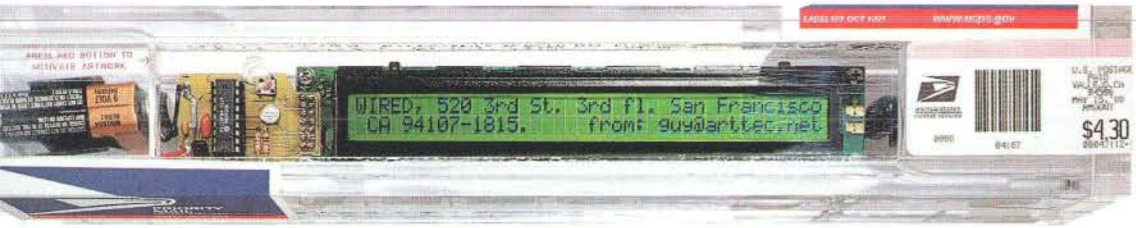
RANTS & RAVES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"Digital Numeric Relevator Mark XX," by Guy Marsden

Literal Translation

The US media has consistently failed to capture the truth about machine translation and the inherent and stubborn limitations in using software to leap the language barrier ("Hello, World," *Wired* 8.05, page 220). Every single media story on MT is a blend of brainless "universal translator" technohype and an irresistible journalistic Pavlovian urge to print silly and irresponsible claims by software vendors. When I first spotted your May cover, I braced myself for the inevitable salivating over how language barriers are about to be smashed to pieces. I was relieved to discover that *Wired* chose to buck this trend and actually report the truth.

Kevin Hendzel
khendzel@asetquality.com

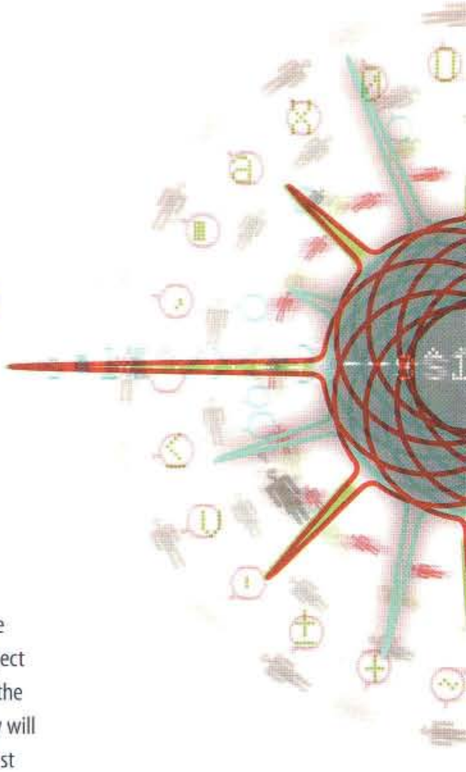
Great feature on MT ("Talking to Strangers," page 224)! A word about Warren Weaver: In 1954 he became agitated about the growing prevalence of atomic radiation, so he appropriated $3 million of Rockefeller Foundation funds for a study by the US National Academy of Sciences on the topic. It was my good luck to be assigned to staff the committee, which consisted of a dazzling array of Nobel laureates, a dozen of the top American geneticists, and subcommittees on agriculture, waste disposal, and other areas of concern. The study alerted the country to the problem and had many indirect results, including banning the X-ray machines then used in shoe stores and stimulating the development of very-low-dosage X-ray machines for dentistry.

Weaver also had cute dimples, which we saw a lot of because he was smiling or laughing most of the time. He needed his sense of humor, because managing that array of geneticists was like running a wild animal act in the circus.

Charles Ali Campbell
alicampbell@ibm.net

Return to Sender

Get a special-edition *Wired* T-shirt if your postal art is selected. See page 263 for rules.



Congratulations on one of the most perceptive articles that I have seen published on the subject of machine translation. You correctly position the central importance that translation technology will play in the future welfare of all cultures, not just those with English speakers.

Japan, for example, has long sponsored MT as a means of gathering economic intelligence from competitors, but now the social implications are being addressed. According to the "Report of the Prime Minister's Commission on Japan's Goals in the 21st Century" (see *www.kantei.go.jp/jp/21century/report/overview.html*), "people must possess the ability to access and converse with the rest of the world, meaning that they can freely and immediately obtain information, understand it, and express their own ideas clearly. The possession or lack of this ability, which we may call 'global literacy,' will determine whether or not one will enjoy a better life in the world of the 21st century."

Guy Bague
gbague@ireland.com

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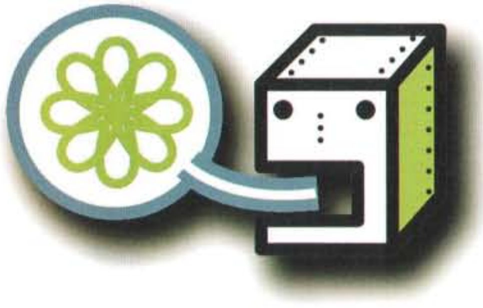

I wanted to add my name to what I am sure is a long list of people who enjoyed the excellent article on machine translation.

I am an industry analyst at IDC, a major market research firm. I have recently started a new market research service here on speech and natural language software. My task is to get beyond the technology and identify and describe markets for software. Right now the speech markets are not very closely related to the natural language software markets, but by the end of the decade, I expect there to be considerable convergence. At the moment I feel like a kid in a candy store. There are so many layers to the story and many niche markets at each layer.

Steve McClure
smcclure@idc.com

As a former MT consultant in the 1970s, I greatly enjoyed your package on global translation, especially Steve Silberman's insightful trek through MT's past and glimpse of the future. However, other than a brief mention in "Talking to Strangers" and the story on VoiceXML ("Capturing Eardrums," page 246), I think the series neglected a key aspect of where the multilingual Internet is heading: the integration of XML-enabled browsers, XML schemas, and Unicode fonts. This integration, rather than MT itself, will be the next major stage in multilingual Internet communication.

Placing multiple languages and fonts on the same Web page is now possible; this will revolutionize international ecommerce through the use of multilingual forms. Once that process matures – and it may take a while – that and other technological developments will help lay the foundation for truly global MT. But we're not quite there yet.

Jim Melnick
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Your article on machine translation was useful and fascinating, but if anything it underestimated the difficulties in creating a general-purpose translator for dissimilar languages. The ambiguities in English are bad enough, but those in other tongues can be much worse. Spoken Chinese, for instance, contains around 1,100 possible syllable sounds (including tonal variants) to express somewhere on the order of 40,000 characters. Chinese speakers frequently resort to scratch pads or tracing characters in the air to clarify which word they mean by a given sound.

The most successful translation engines deal with basically similar pairs such as English and German, and even these are fit only for specialized use. I am highly skeptical that a digital computer program will ever be able to translate accurately between truly different languages.

Robert A. Benzinger
icebear@dc.net

Listen Up

I'm still having a hard time believing some of Tellme CEO Mike McCue's comments ("Capturing Eardrums," *Wired* 8.05, page 246). He's actually encouraging people to eschew a higher education simply because we're not in a recession? With advice like that, we'll soon be knee-deep in wealthy, technologically savvy, but ultimately uncultured louts. In the end, it's not just about the money, Mr. McCue; it's about what sort of life you lived.

Jaime Muldoon Gómez
jaime@siteshapers.com

Advances in voice recognition technology developed by Tellme will surely be innovative, but their business model is seriously flawed. Tellme faces a double-edged sword in generating revenue. The more aggressive their ads are, the less users will get what they really want – quick and easy information. For instance, Joe Fan wants to know the score of the Raiders game. If Tellme bombards him with ads upfront, he might stay around for the score but next Sunday he'll watch ESPN instead, where he can see highlights, scores, and news from around the league. If he gets bored, he can flip to the Weather Channel. On the other hand, if the ads are pitched after the score, Tellme's advertisers will reach a lot of dial tones.

Really, how many ads can you cram into a telephone call without being annoying?

Josh Howard
moehoward1998@yahoo.com

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93	Stolichnaya Gold Vodka	Russia
92	Staraya Moskva Premium	Russia
91	Van Hoo Vodka	Belgium
91	Stolichnaya Vodka	Russia
90	Tanqueray Sterling Vodka	England
90	Rain 1995 Harvest Vodka	USA
89	Ketel One Vodka	Holland
88	Wyborowa Vodka	Poland
87	Kremlyovskaya Vodka	Russia
86	Finlandia Vodka of Finland	Finland
86	Alps French Vodka	France
85	Skyy Vodka	USA
82	Original Polish Vodka	Poland
82	Glenmore Special	USA
82	Fleischmann's Royal Vodka	USA
81	Mr. Boston Vodka	USA
80	Pole Star Vodka	Poland
80	Luksusowa Potato Vodka	Poland
80	Absolut Vodka	Sweden
78	Cardinal Vodka	Holland
78	Barton Vodka	USA
78	Barclay's Vodka	USA
78	Amazon Vodka	Brazil
76	Skol Vodka	USA
74	Smirnoff Vodka	USA
74	Crystal Palace Vodka	USA
74	Belvedere	Poland
72	Schenley	USA
69	Mr. Boston's Riva Vodka	USA

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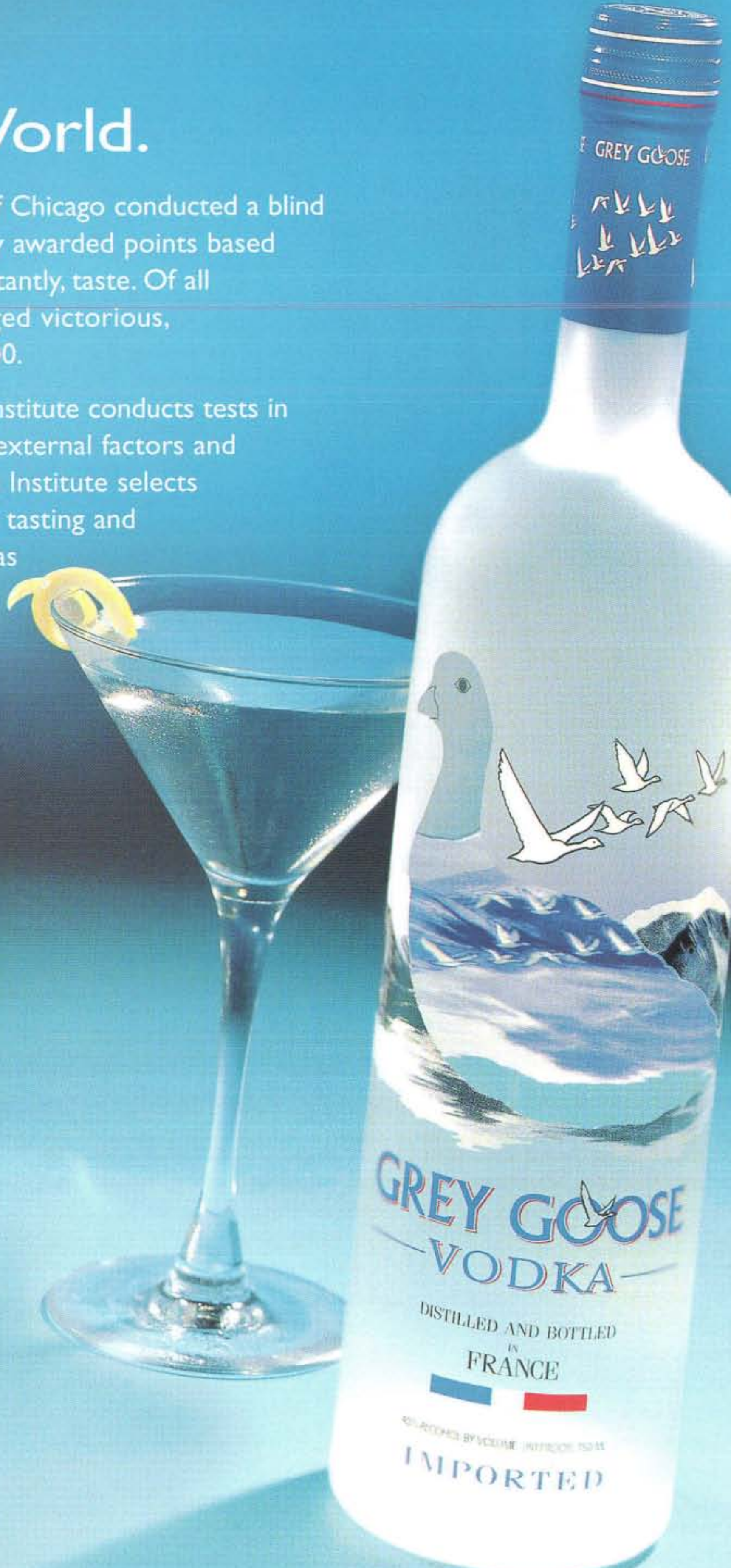

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RANTS & RAVES

Tripping Out

Erik Davis' interview with Terence McKenna ("Terence McKenna's Last Trip," *Wired* 8.05, page 156) is a special kind of document. Davis is a terrific writer and thinker, capable of connecting with Terence in a most insightful way. And as this was the last interview, alas, with McKenna, it catches this wonderful man's thoughts and reflections as his life is coming to a close.

Stephen Miller
mkzdk@mkzdk.org

In my view, Terence McKenna was merely an undisciplined voyager within the labyrinths of the mind, and not a "real visionary" or heroic figure. Psychedelics, when used to deconstruct reality for recreation, are habit-forming, destructive, and most often deadly.

Entheogens, briefly administered, can be useful in providing a liberating and nondual view of reality. The remainder of the journey toward enlightenment is drug-free.

Edward Plotkin
info@fouryogas.com

Erik Davis presented Terence McKenna as someone who is not afraid of what's out there, nor what's inside himself. He presented McKenna as someone who appears to have taken brave steps toward what might be the source of creativity and invention. I find that quite inspirational.

Chris Walsh
walsh@netcom.ca

Deep Freeze

I am a poet and composer, a person who deliberately cultivates a sensitivity for the poignant and the beautiful. But a piece of writing about scientific exploration never moved me to tears until I read the last three paragraphs of the essay about Lake Vostok ("Ice Station Vostok," *Wired* 8.04, page 121). The vast sweep of time, the longest night, the return of the dawn after 100 million years – how majestic, how beautiful! An idea this grand could easily inspire great art.

John C. Grannis
crossroads@viconet.com

"Ice Station Vostok" missed perhaps the most important point of debate, especially considering the April cover story ("Why the Future Doesn't Need Us," *Wired* 8.04, page 238) and its questioning of the ethics of human interference with nature: What if the bacteria that these scientists bring up from the depths adapt and destroy other life-forms on this planet, like us? The potential harm to life on the surface from 30-million-year-old organisms cannot be ascertained by the speculations of a so-called intelligent species.

We have a saying in Kazakhstan that is very similar to what your grandmothers tell you: Leave well enough alone.

Gtron Sistem
gtronsistem@hotmail.com

Comeback Kids

Good article on the older executives coming back for round two ("Act 2.0," *Wired* 8.05, page 188). While these old-school execs have operational knowledge of business, their fundamental lack of experience with the underlying technology and its application could handicap their leadership capabilities. I'm not suggesting that they need to know Java, but they should understand the possibilities for information delivery. Jeff Bezos and Pehong Chen certainly do. The experience and advice of the execs in the article would be absolutely invaluable, and I would not mind having one of them as a corporate officer. But I would not want them to have the final word.

Phil Adams
pcadams@firesteedsoftware.com

Undo

→ Risk Management: AIG canceled or did not renew $1 billion in unprofitable insurance premiums over the last two years ("The Wired Index," *Wired* 8.06, page 229). → Accountable: Merrill Lynch & Co. gained $36 billion in private-client accounts in Q4 1999 ("Financial Services Monster Mash," *Wired* 8.05, page 285); Merrill Lynch Direct accounts amounted to around 2 percent. → Deconstruction: Cephren's extranet ("Pyramid Power," *Wired* 8.03, page 106) was used in the design, not the construction, of the Venetian Resort-Hotel-Casino.

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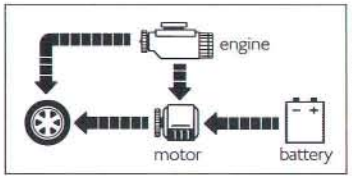

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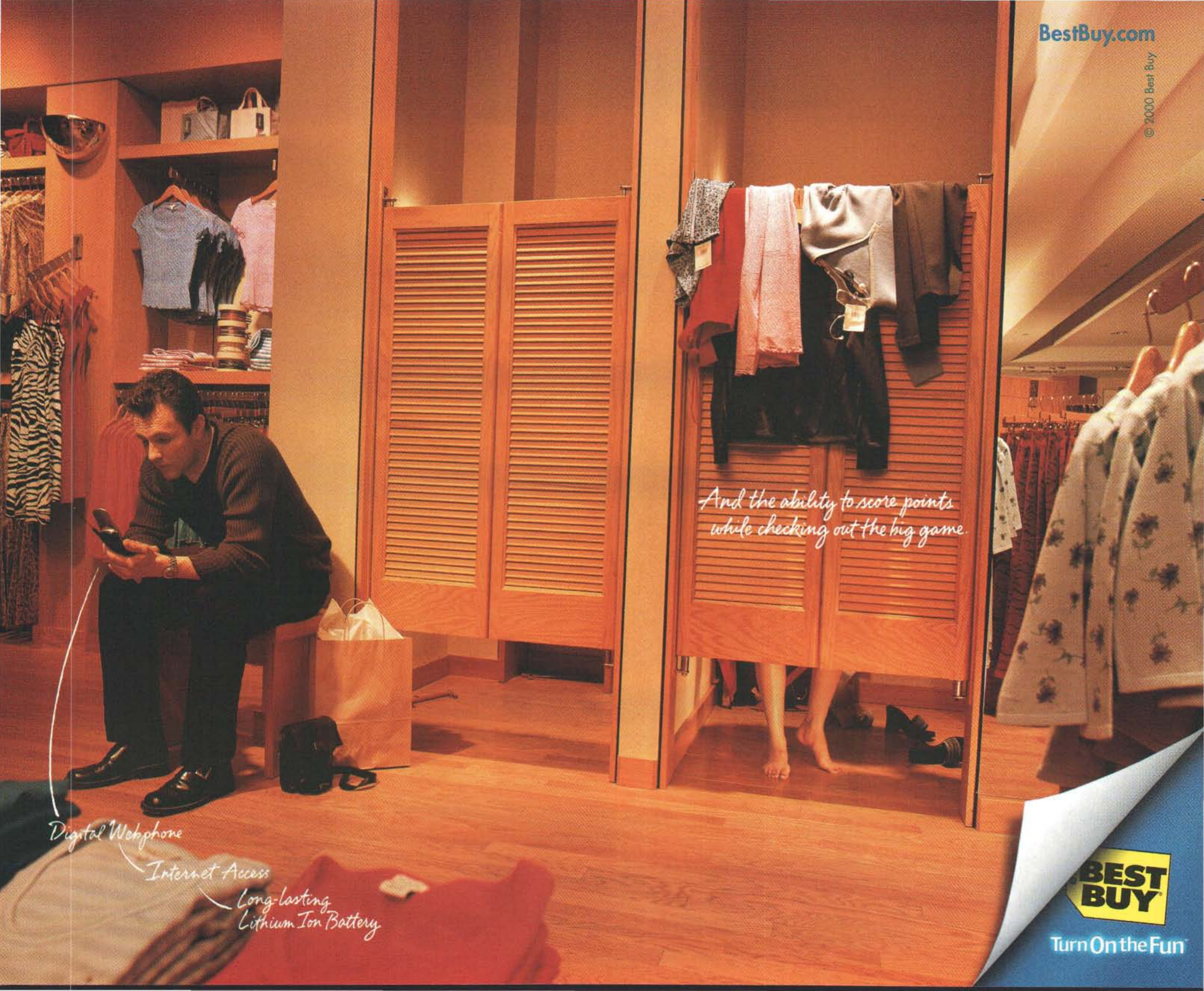
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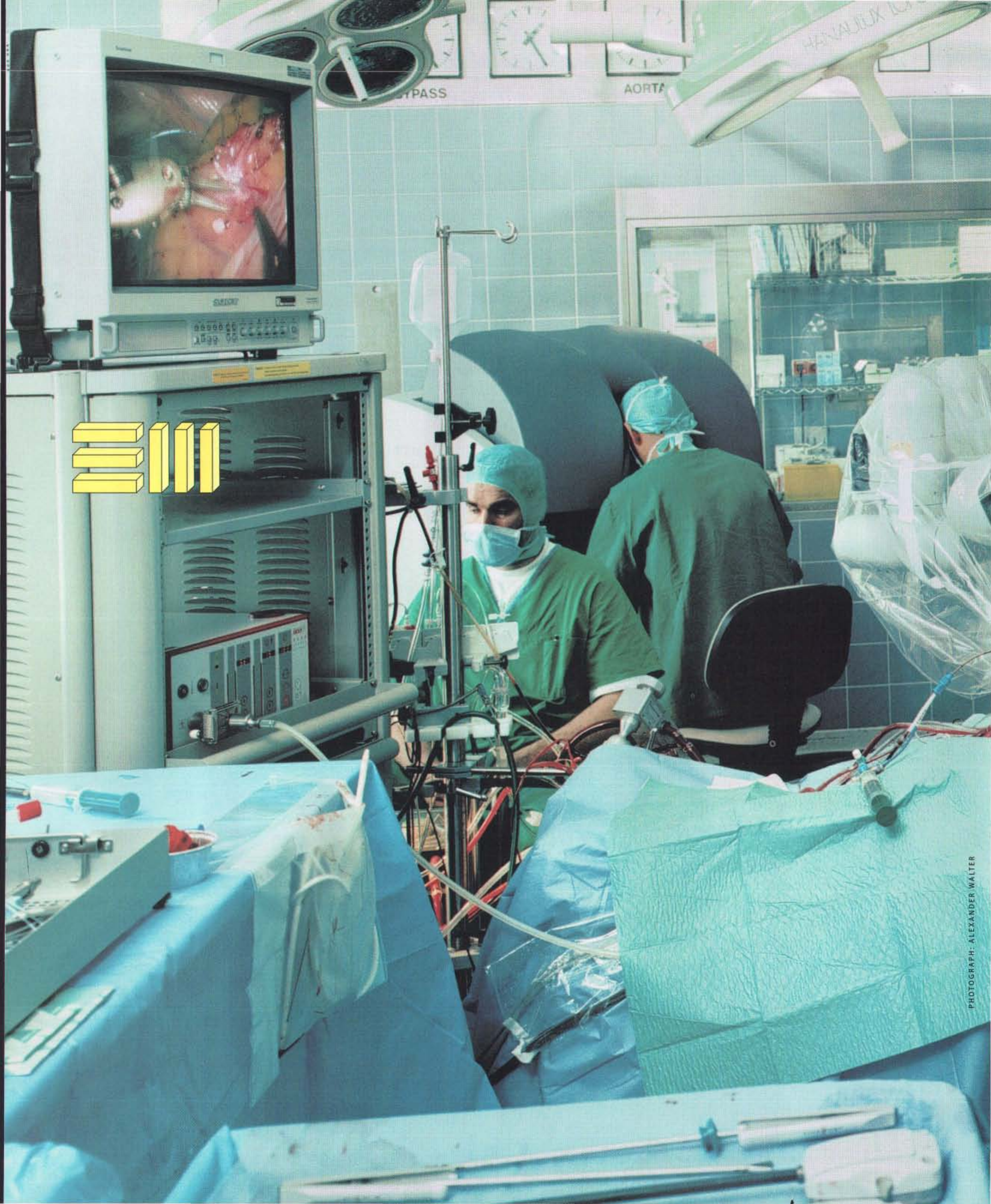
→THE MIRROR HACK'D

Andy Ouderkirk and fellow 3M scientist Mike Weber were zapping polymers with powerful lasers as part of a materials science experiment when Ouderkirk realized he could bind together hundreds of sheets of polymer film to create a highly reflective material. The resulting plastic mirror is much cheaper to produce than the traditional vacuum-coated glass variety. And it reflects light waves from across the spectrum: Because the film doesn't absorb infrared, it can be used as an invisible window coating, screening out solar rays without blocking any visible light and radio waves, as metallic screens do. 3M plans to launch its first plastic-mirror products later this year. "There's an incredible breadth of apps," says Ouderkirk. "We're having a good time exploring." – *Valerie Cover*



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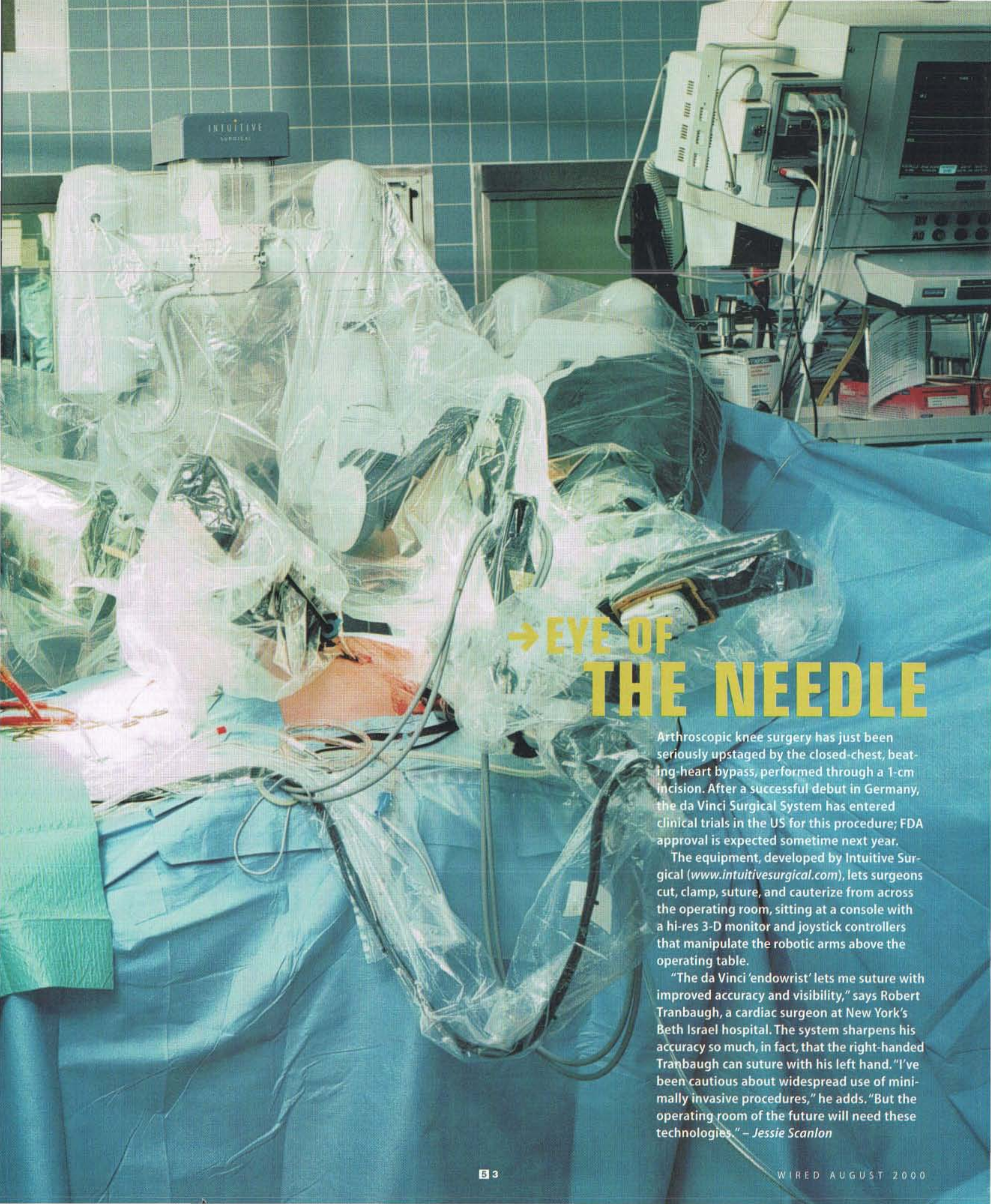
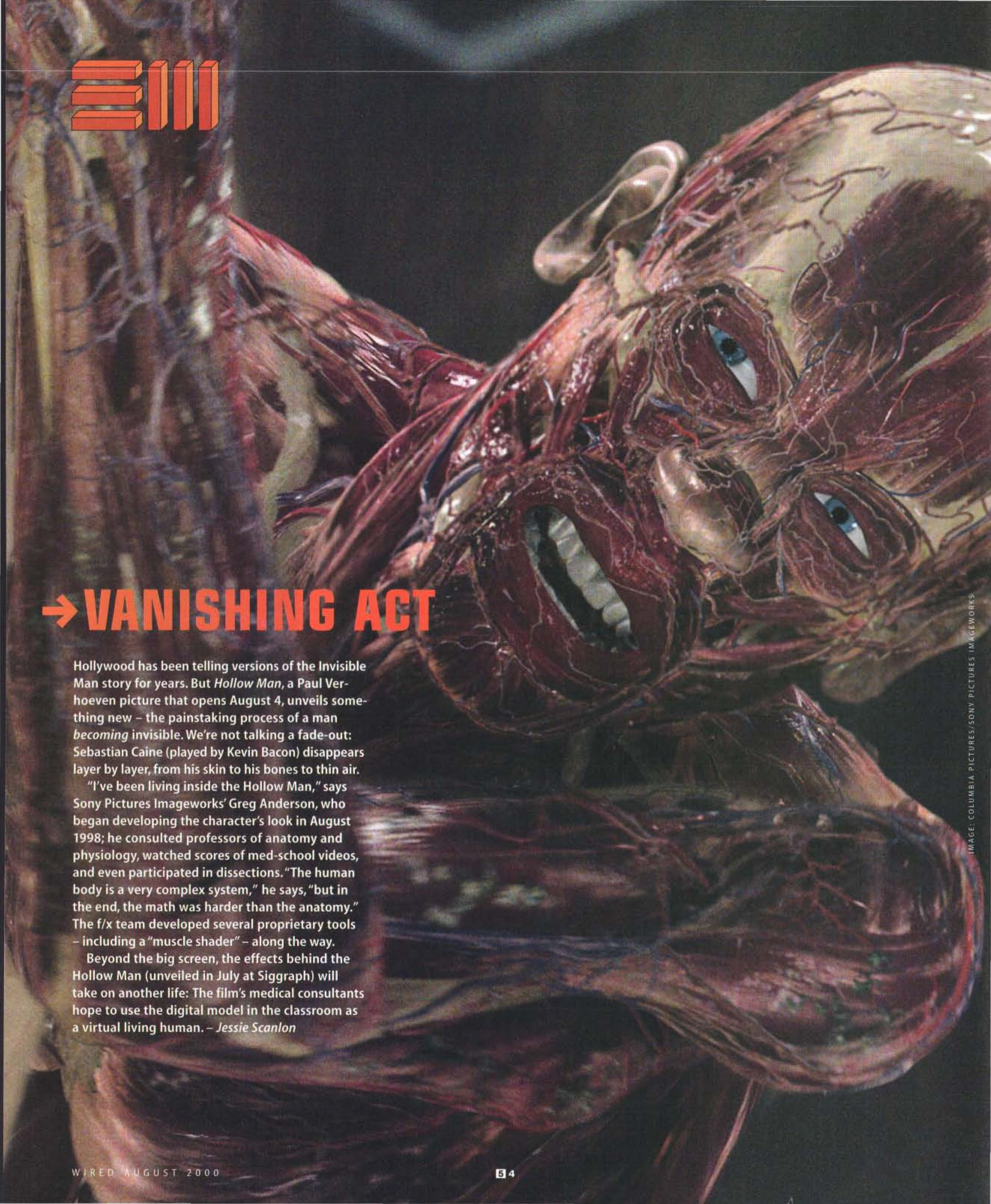


→EYE OF THE NEEDLE

Arthroscopic knee surgery has just been seriously upstaged by the closed-chest, beating-heart bypass, performed through a 1-cm incision. After a successful debut in Germany, the da Vinci Surgical System has entered clinical trials in the US for this procedure; FDA approval is expected sometime next year.

The equipment, developed by Intuitive Surgical (*www.intuitivesurgical.com*), lets surgeons cut, clamp, suture, and cauterize from across the operating room, sitting at a console with a hi-res 3-D monitor and joystick controllers that manipulate the robotic arms above the operating table.

"The da Vinci 'endowrist' lets me suture with improved accuracy and visibility," says Robert Tranbaugh, a cardiac surgeon at New York's Beth Israel hospital. The system sharpens his accuracy so much, in fact, that the right-handed Tranbaugh can suture with his left hand. "I've been cautious about widespread use of minimally invasive procedures," he adds. "But the operating room of the future will need these technologies." – *Jessie Scanlon*



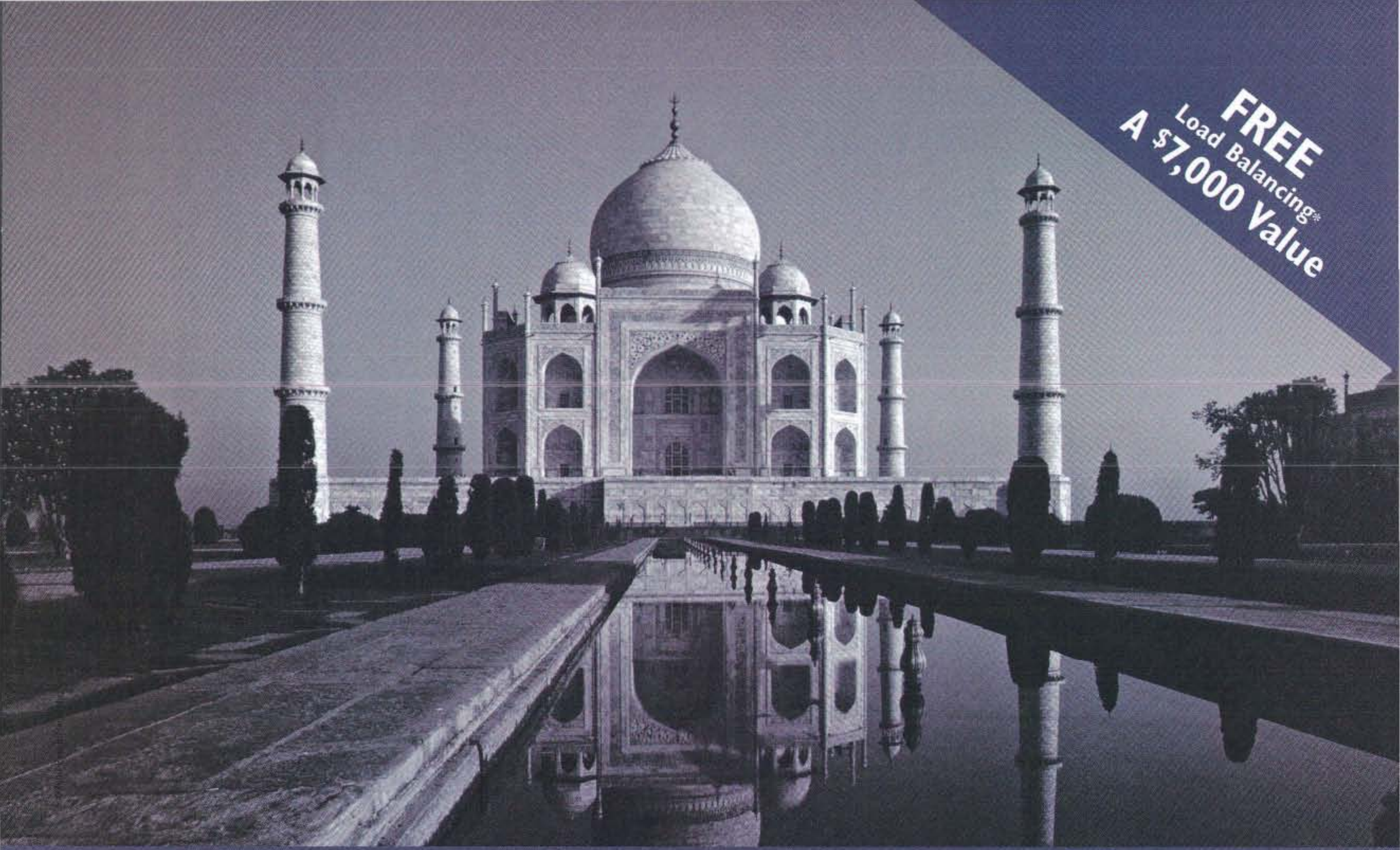
→VANISHING ACT

Hollywood has been telling versions of the Invisible Man story for years. But *Hollow Man*, a Paul Verhoeven picture that opens August 4, unveils something new – the painstaking process of a man *becoming* invisible. We're not talking a fade-out: Sebastian Caine (played by Kevin Bacon) disappears layer by layer, from his skin to his bones to thin air.

"I've been living inside the Hollow Man," says Sony Pictures Imageworks' Greg Anderson, who began developing the character's look in August 1998; he consulted professors of anatomy and physiology, watched scores of med-school videos, and even participated in dissections. "The human body is a very complex system," he says, "but in the end, the math was harder than the anatomy." The f/x team developed several proprietary tools – including a "muscle shader" – along the way.

Beyond the big screen, the effects behind the Hollow Man (unveiled in July at Siggraph) will take on another life: The film's medical consultants hope to use the digital model in the classroom as a virtual living human. – *Jessie Scanlon*

IMAGE: COLUMBIA PICTURES/SONY PICTURES IMAGEWORKS



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→ VISUALIZE

WORLD GEEKS

PHOTOGRAPH: JESSICA WYNNE

Before Ethan Zuckerman became an accidental millionaire, the Tripod cofounder spent a year in Ghana as a Fulbright scholar. Now the high-energy 27-year-old is going back with his new startup, Geekcorps (*www.geekcorps.org*), which he began with Elisa Korentayer (below). The nonprofit plans to send tech workers to developing nations to build ecommerce systems, teach Java to coders who work in Cobol, and deliver other tech know-how. The first six volunteers will arrive in Ghana's capital, Accra, in late September.

Zuckerman describes Geekcorps as a "dot-org" – an effort guided by the fast-paced mind-set of the industry rather than the nonprofit tradition of proposals, grants, and rigid multiyear project plans. "We want to use venture capital, interface creatively with businesses, and take ideas to market in six months." – *Paul Boutin*

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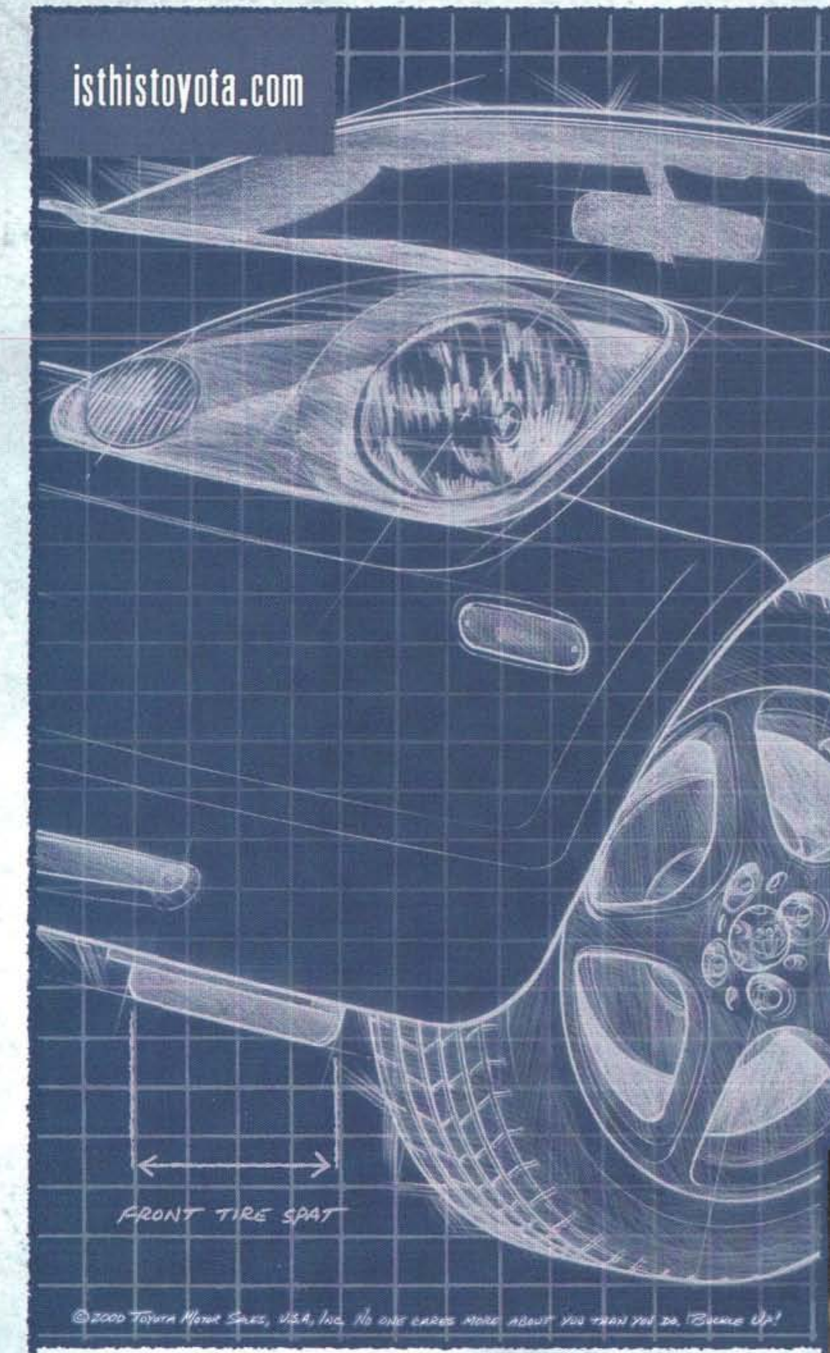

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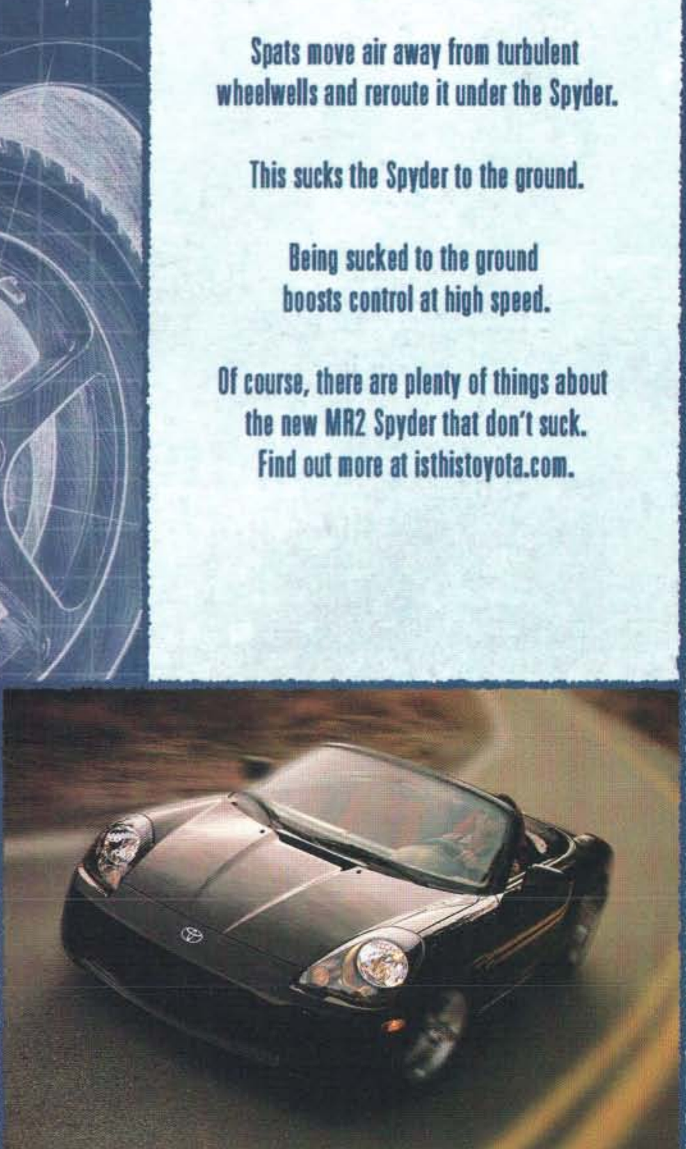

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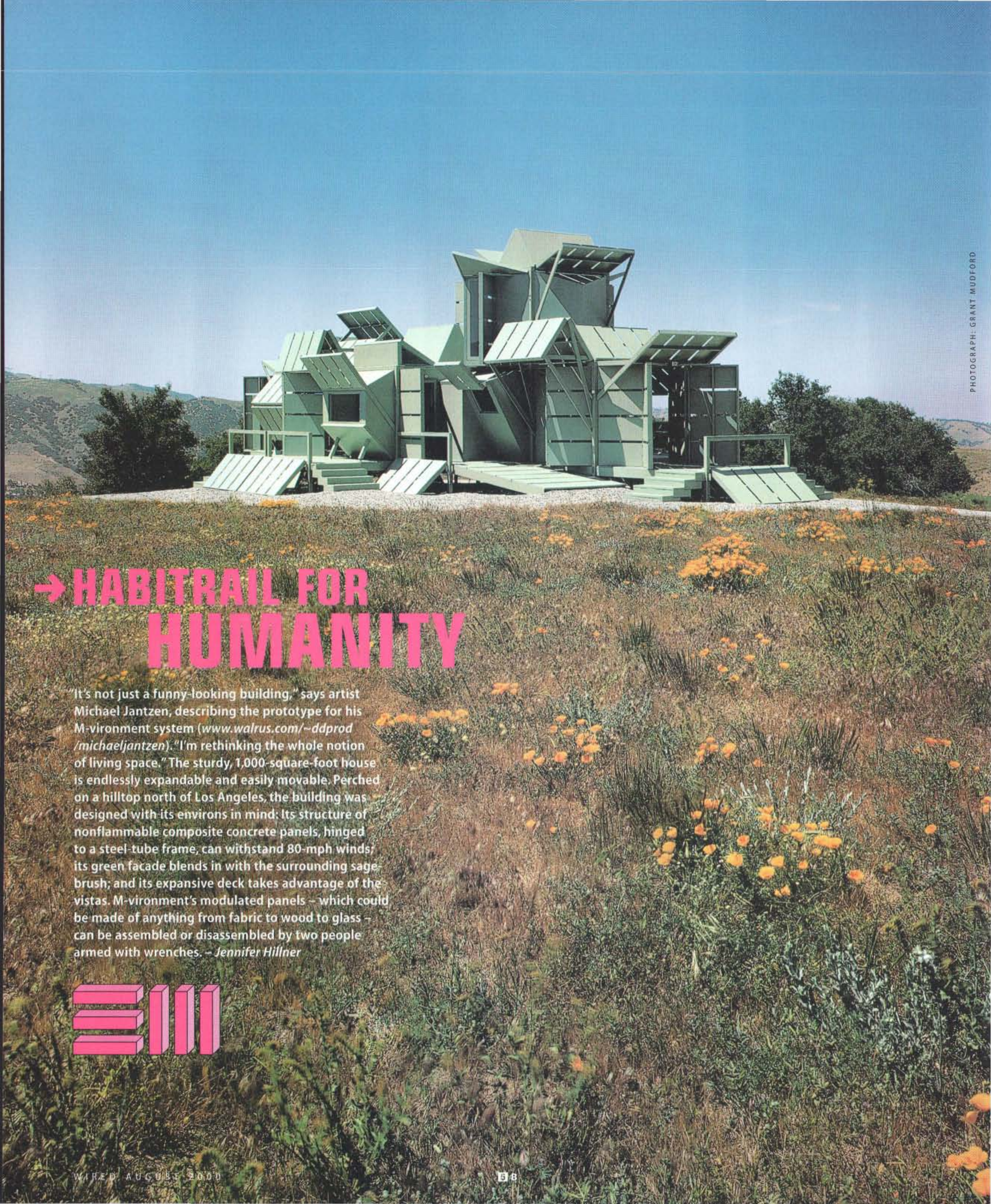

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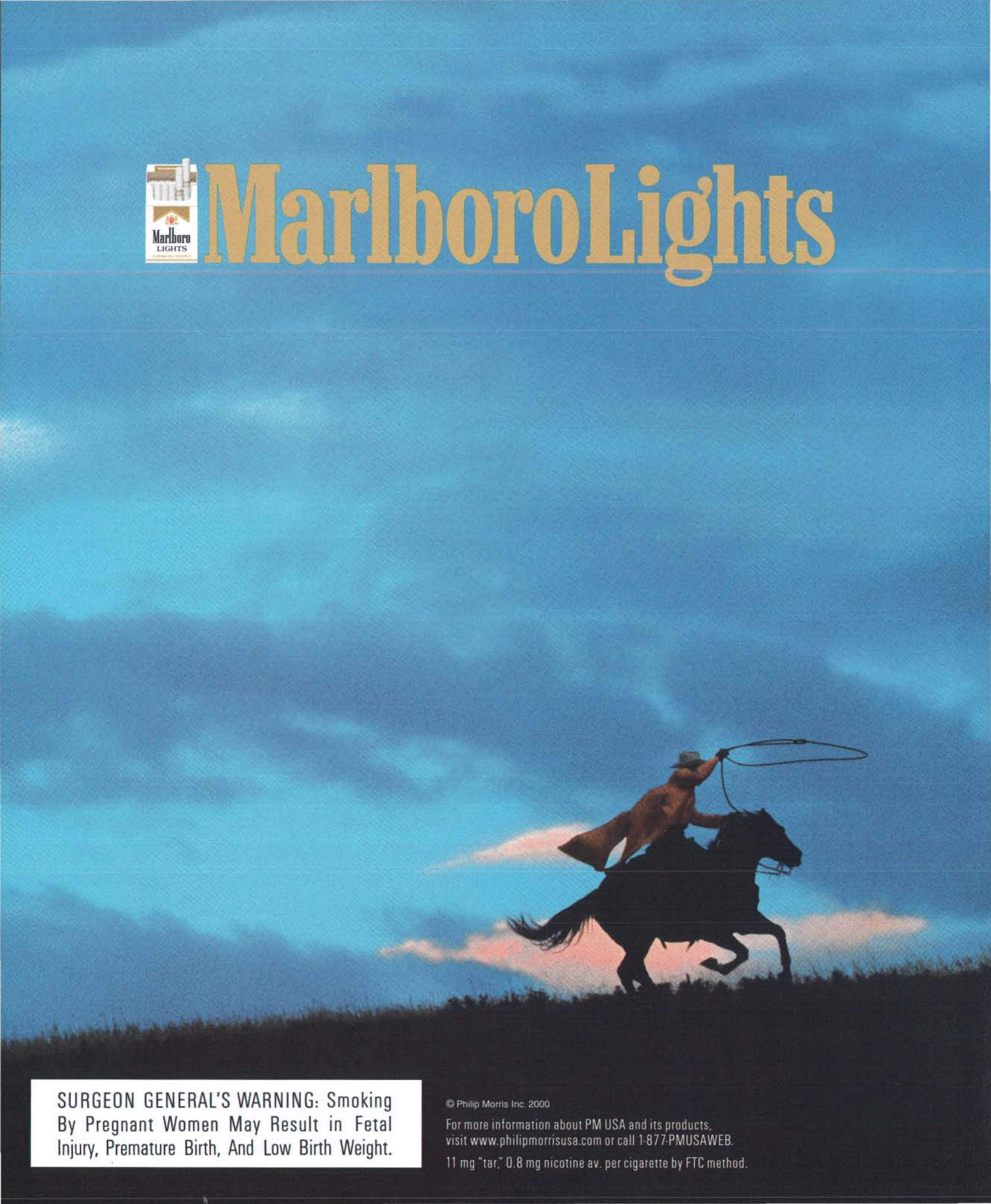
→ HABITRAIL FOR HUMANITY

"It's not just a funny-looking building," says artist Michael Jantzen, describing the prototype for his M-vironment system (*www.walrus.com/~ddprod/michaeljantzen*). "I'm rethinking the whole notion of living space." The sturdy, 1,000-square-foot house is endlessly expandable and easily movable. Perched on a hilltop north of Los Angeles, the building was designed with its environs in mind: Its structure of nonflammable composite concrete panels, hinged to a steel-tube frame, can withstand 80-mph winds; its green facade blends in with the surrounding sagebrush; and its expansive deck takes advantage of the vistas. M-vironment's modulated panels – which could be made of anything from fabric to wood to glass – can be assembled or disassembled by two people armed with wrenches. – *Jennifer Hillner*



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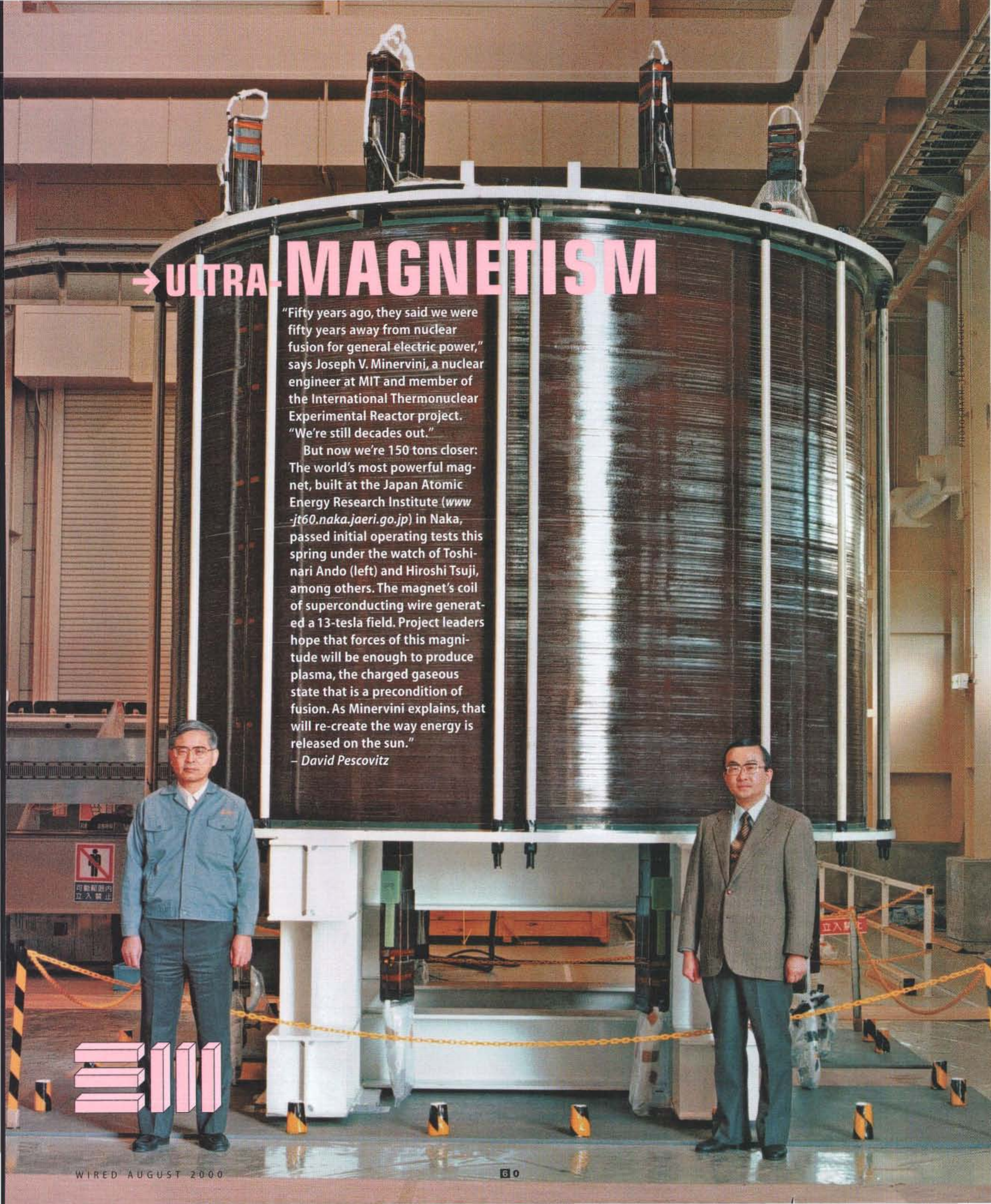


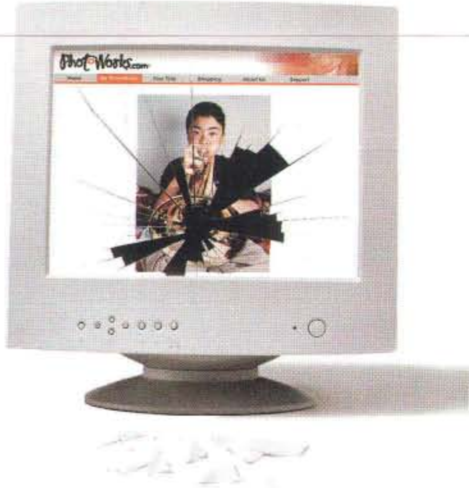
→ ULTRA-MAGNETISM

"Fifty years ago, they said we were fifty years away from nuclear fusion for general electric power," says Joseph V. Minervini, a nuclear engineer at MIT and member of the International Thermonuclear Experimental Reactor project. "We're still decades out."

But now we're 150 tons closer: The world's most powerful magnet, built at the Japan Atomic Energy Research Institute (*www-jt60.naka.jaeri.go.jp*) in Naka, passed initial operating tests this spring under the watch of Toshinari Ando (left) and Hiroshi Tsuji, among others. The magnet's coil of superconducting wire generated a 13-tesla field. Project leaders hope that forces of this magnitude will be enough to produce plasma, the charged gaseous state that is a precondition of fusion. As Minervini explains, that will re-create the way energy is released on the sun."

– David Pescovitz

PHOTOGRAPH: TETSUO TAGUCHI



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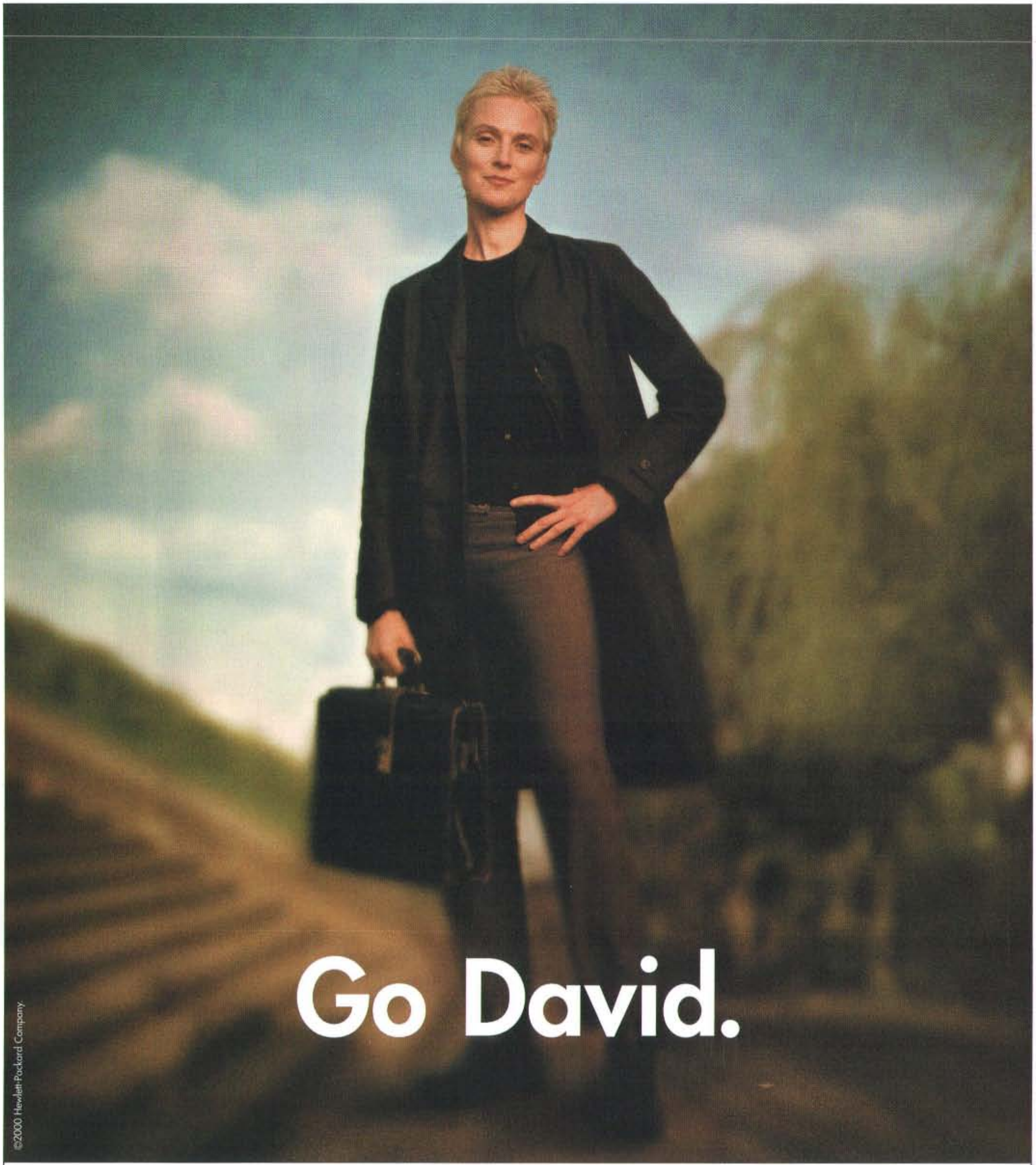

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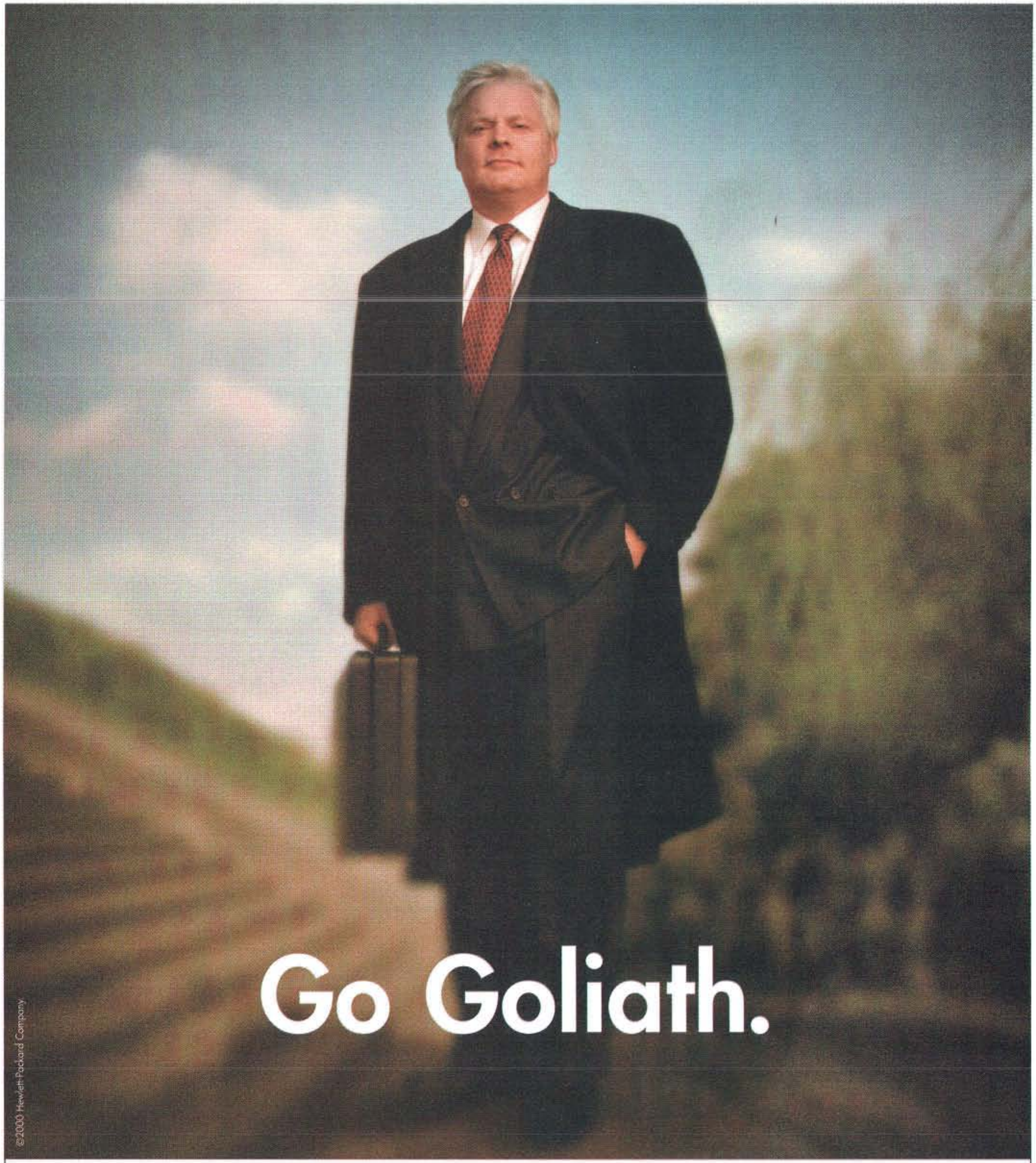
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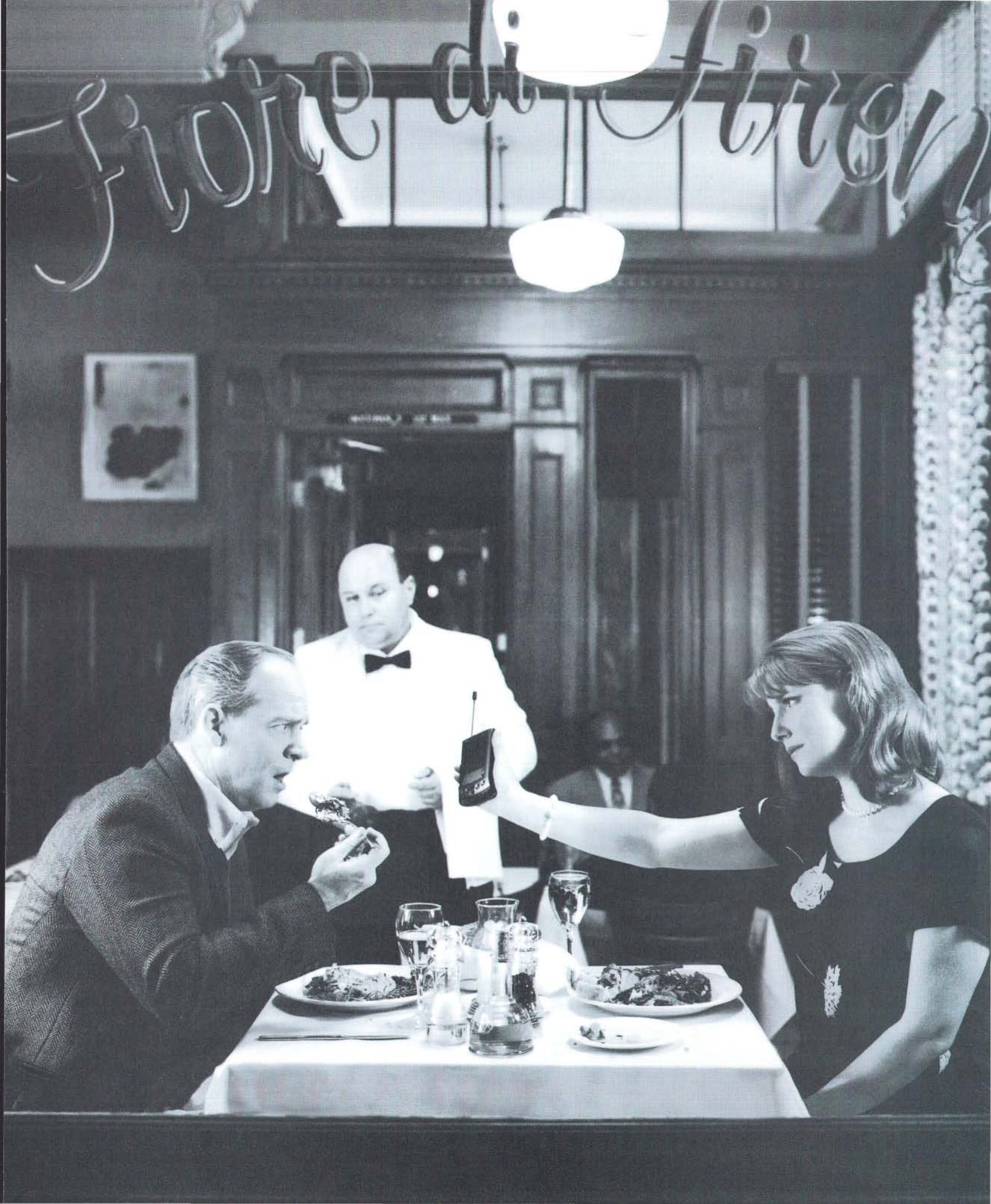
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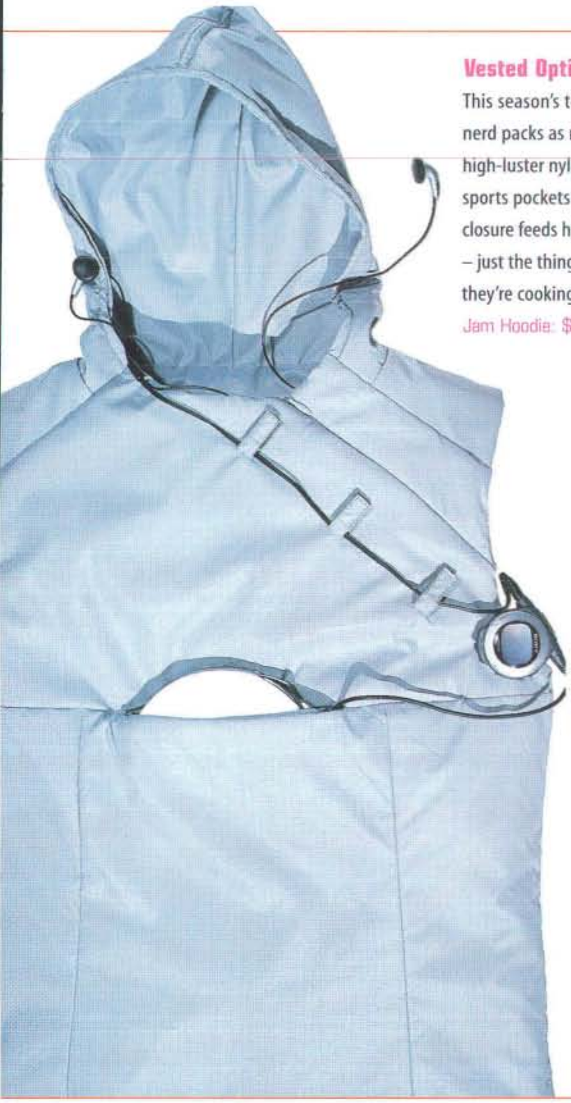
FETISH

By Paul Spinrad



Vested Options

This season's tech-ready women's wear is as far from belt-loop nerd packs as mezz financing is from network engineering. Take the high-luster nylon number, by ufunction, pictured here: The Jam Hoodie sports pockets for both cell phone and personal stereo. Its diagonal closure feeds headphone wires up from the player into the deep hood – just the thing for cold-sweating SVPs who can't be bothered when they're cooking up revolutionary business models on the StairMaster.

Jam Hoodie: $85. ufunction: (888) 579 0784, *www.ufunction.com.*

Old Piano Rolls Blues

The Disklavier Pro 2000 combines a piano with a Pentium III to create the perfect background-music cyborg. At its base is a 7.5-foot concert grand, dressed up with brushed aluminum and Lucite – call it Liberace by way of Ikea. On top of that, the DVD-based MIDI player can show videos, run mood-lighting changes, and literally reproduce live performances. A voice recognition system controls basic operations, though it won't understand drunken requests for "Melancholy Baby."

Disklavier Pro 2000: $330,000. Yamaha: +1 (714) 522 9011, *www.yamaha.com.*

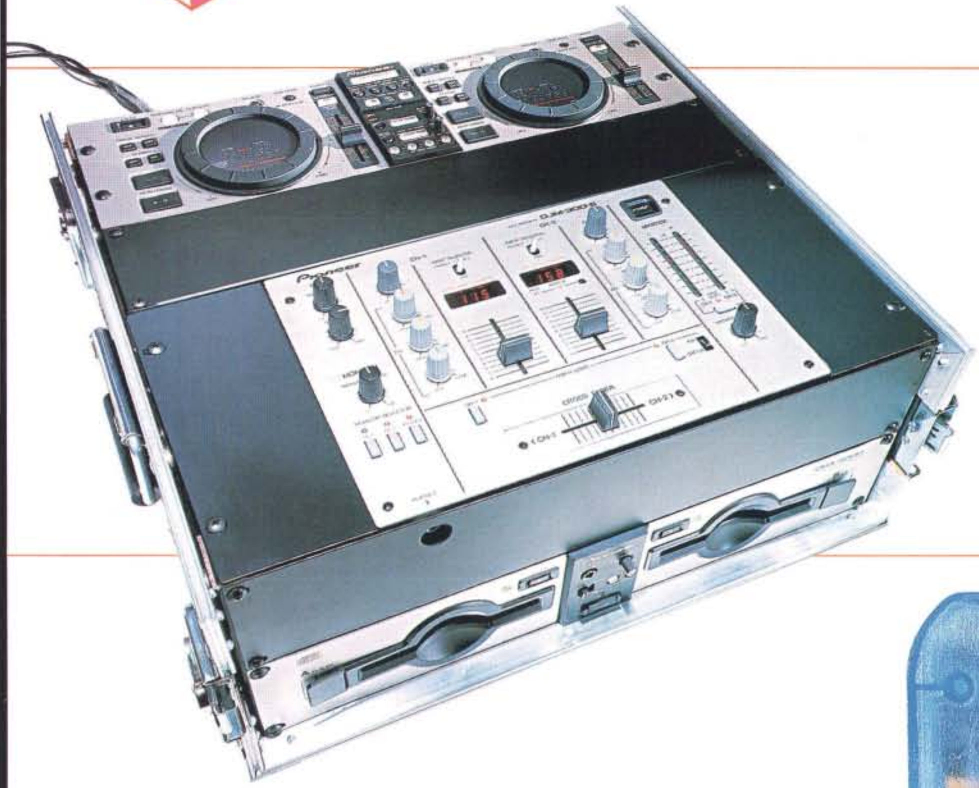
Cellular Division

Hang ViperCell antennas on the walls of your company's far-flung locations, connect them to the Ethernet, and pow: Your branch offices are now free-calling zones for cell phones. Using cellular voice-over-IP, ViperCell intercepts calls or messages sent with GSM or PCS phones, then routes them via your network – and your regular cell provider will never know.

ViperCell: price TBA. Cisco Systems: (800) 553 6387, +1 (650) 330 2800, *www.cisco.com.*

PHOTOGRAPHS: LEFT AND BOTTOM RIGHT: MORTEN KETTEL. STYLING BY JOHN MORTIMER/ARTIST UNTIED. TOP RIGHT: NIGEL COX

FETISH



Spin Doctor

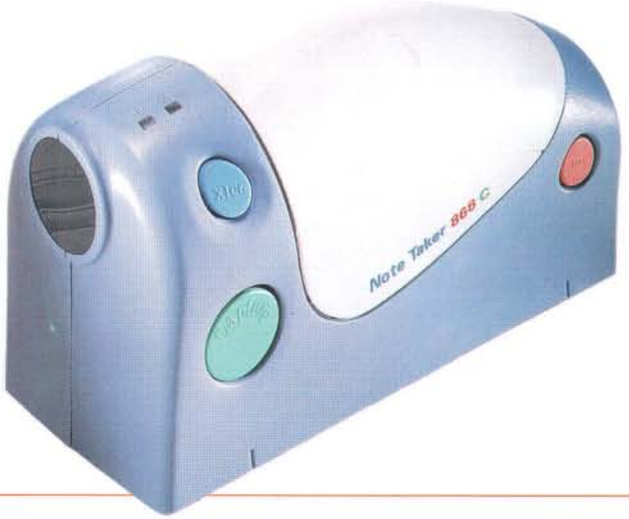
DJs are slaves to the rhythm. They may control the selection, but keeping the beat smooth during segues demands painstaking precision. Pioneer's CMX-5000 eliminates the drudge work by mixing transitions automatically – no cuing required. Nicknamed "Stealth," the professional twin-CD player uses a DSP chip and an 8-second buffer to count beats per minute, align tracks, and seamlessly cut or fade. The rack-mounted unit also adjusts tempo and sets automatic cue-in points – further tricks that let mixmasters look cool while they lay down the perfect, no-rest dance set.

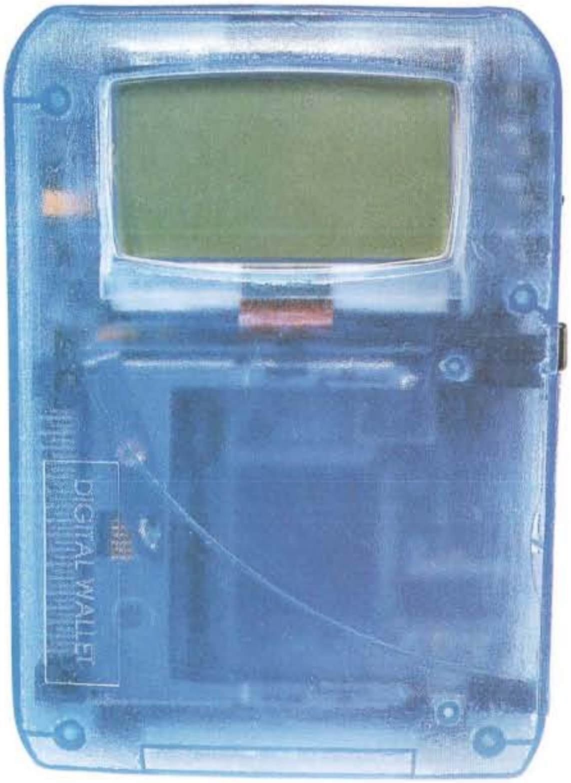
CMX-5000: $1,799. Pioneer: (800) 872 4159, +1 (310) 952 2111, *www.pioneerprodj.com.*

Over the Rainbow

Pity the poor pocket scanner doomed to reproduce the world in workaday grayscale. Abera's NoteTaker 868C, by contrast, captures full color. The 15-ounce, 6-inch-long unit sucks up photos, fabrics, priceless paintings, and napkin-note brainstorms at 300 dpi. A single sweep grabs up to 22 inches – enough for a full newspaper column; included page-manager software re-creates full-page originals by stitching together the 4-inch-wide swaths. Images save as JPEG or BMP files and upload via USB or IR port.

NoteTaker 868C: $299. Abera Technologies: +1 (714) 593 9946, *www.abera-tech.com.*





Information Economy

Vacation memories are priceless, but memory cards are expensive. Time to tap into the Digital Wallet, a 6-Gbyte portable storage unit that grabs data off Flash cards from all kinds of devices, storing digital images, audio files, databases, spreadsheets, you name it. Using an adapter, the wallet, which has its own power and screen interface, also works with Clik! disks and Memory Sticks. Back at home, you can connect to the USB port of your PC or Mac for a quick data exchange; it's also great for archiving and backups.

Digital Wallet 6G: $499. Minds@Work: (800) 459 5799, +1 (949) 707 0600, *www.mindsatwork.net.*

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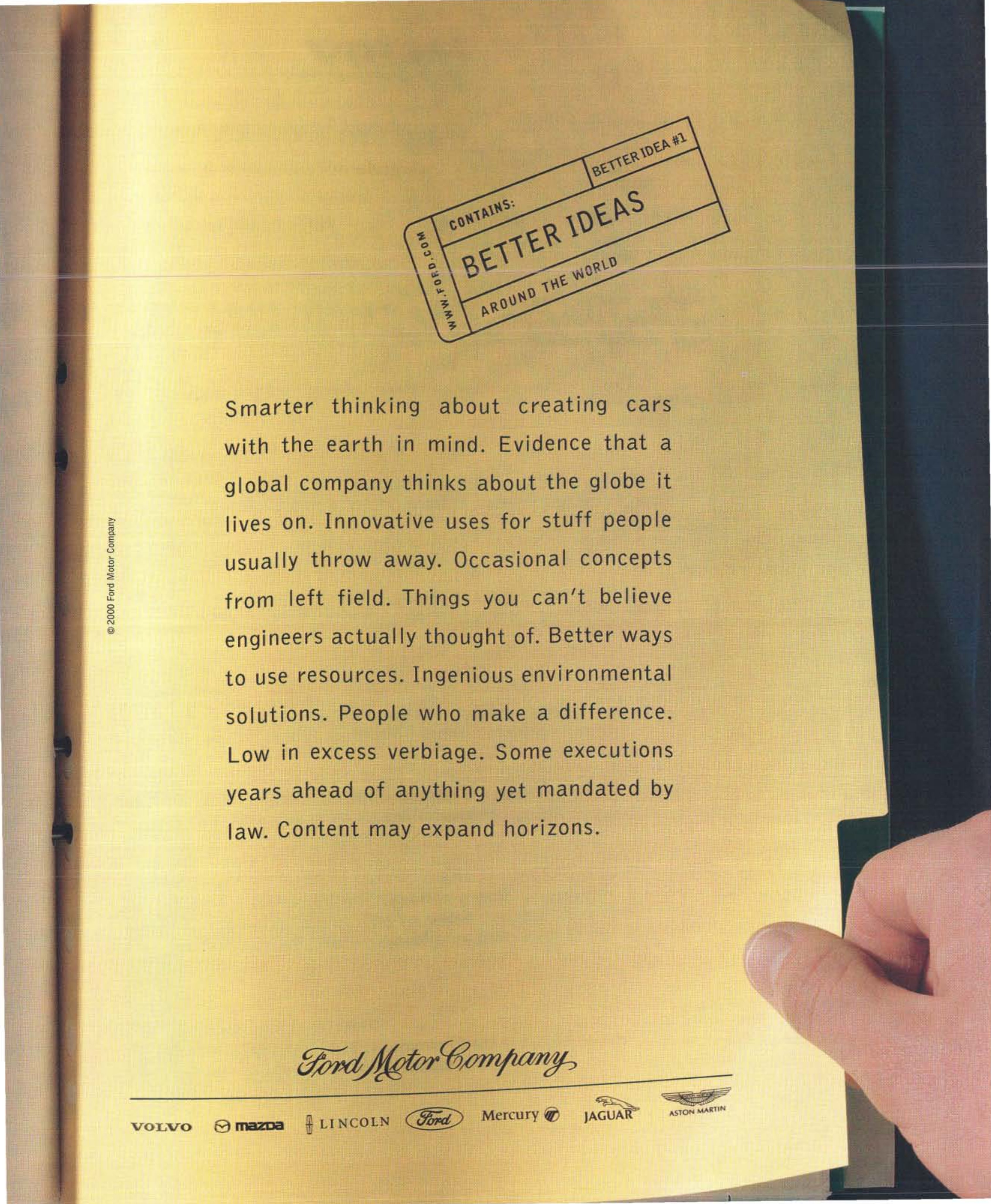

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CD Now

Your first MP3 player was thrilling, till that weekend trip you OD'd on the 10 songs it could store. One solution: the portable Mambo-X, which plays traditional store-bought CDs *and* home-burned CD-R and CD-RW discs, which can hold up to 10 hours of MP3 music. Plus, you can plug the Mambo-X in to your stereo and run it with its own infrared remote.

Mambo-X P300: $199.95.
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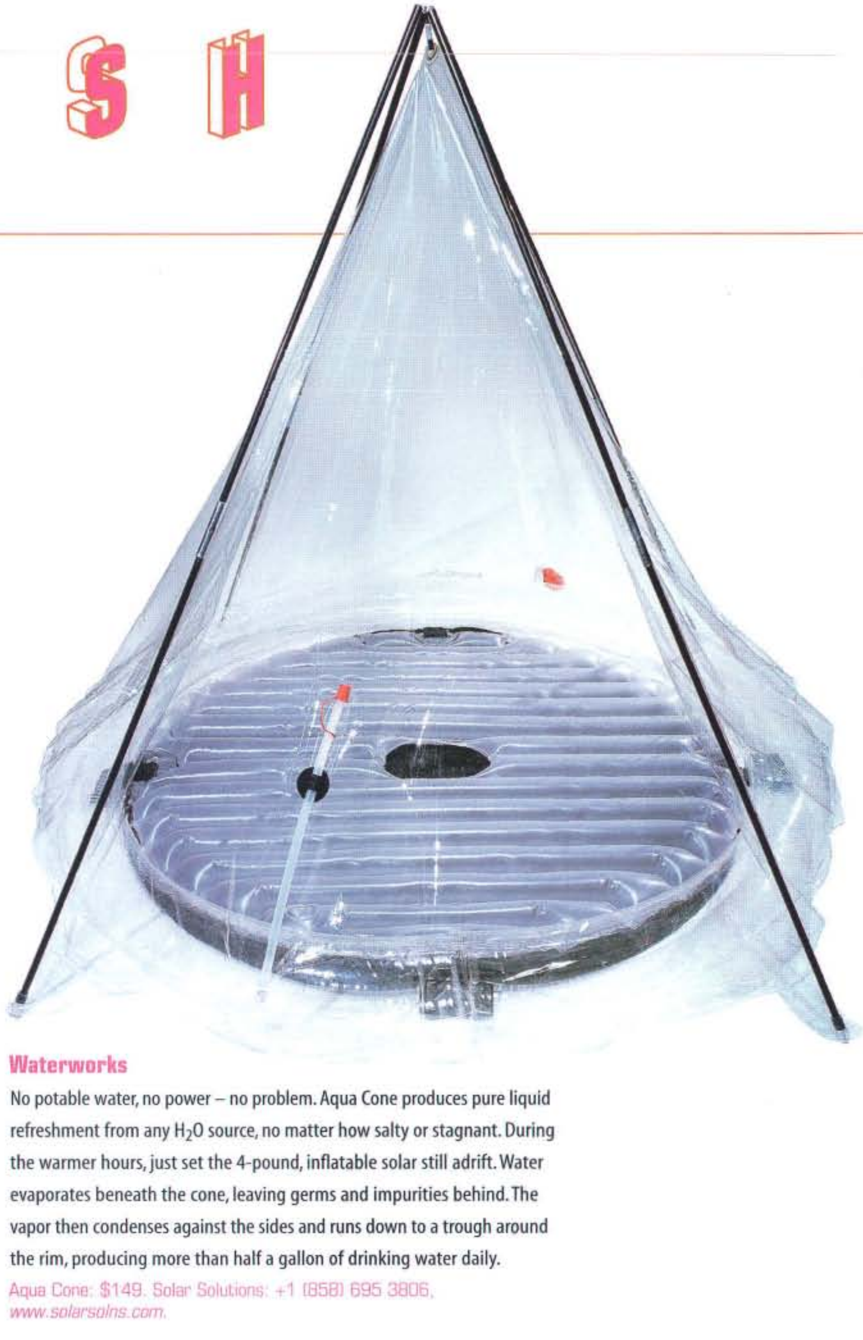

Waterworks

No potable water, no power – no problem. Aqua Cone produces pure liquid refreshment from any H_2O source, no matter how salty or stagnant. During the warmer hours, just set the 4-pound, inflatable solar still adrift. Water evaporates beneath the cone, leaving germs and impurities behind. The vapor then condenses against the sides and runs down to a trough around the rim, producing more than half a gallon of drinking water daily.

Aqua Cone: $149. Solar Solutions: +1 (858) 695 3806,
www.solarsolns.com.

Permanent Record

Business documents come and go, but, boy, it hurts when that candid shot from the company picnic fades because it was output on office equipment. The Stylus Pro 2000P printer keeps your memories sharp with archival inks Epson says will last 200-plus years – that's 1.6 millennia in Internet time. The inkjet prints at 1,440 x 720 dpi on archival matte, semigloss, or photo paper measuring up to 13 by 44 inches. Future cube farmers will appreciate all the magic moments you bequeath from the dawn of the digital age.

Stylus Pro 2000P: $899. Epson America: (800) 463 7766, +1 (562) 290 4000, *www.epson.com.*

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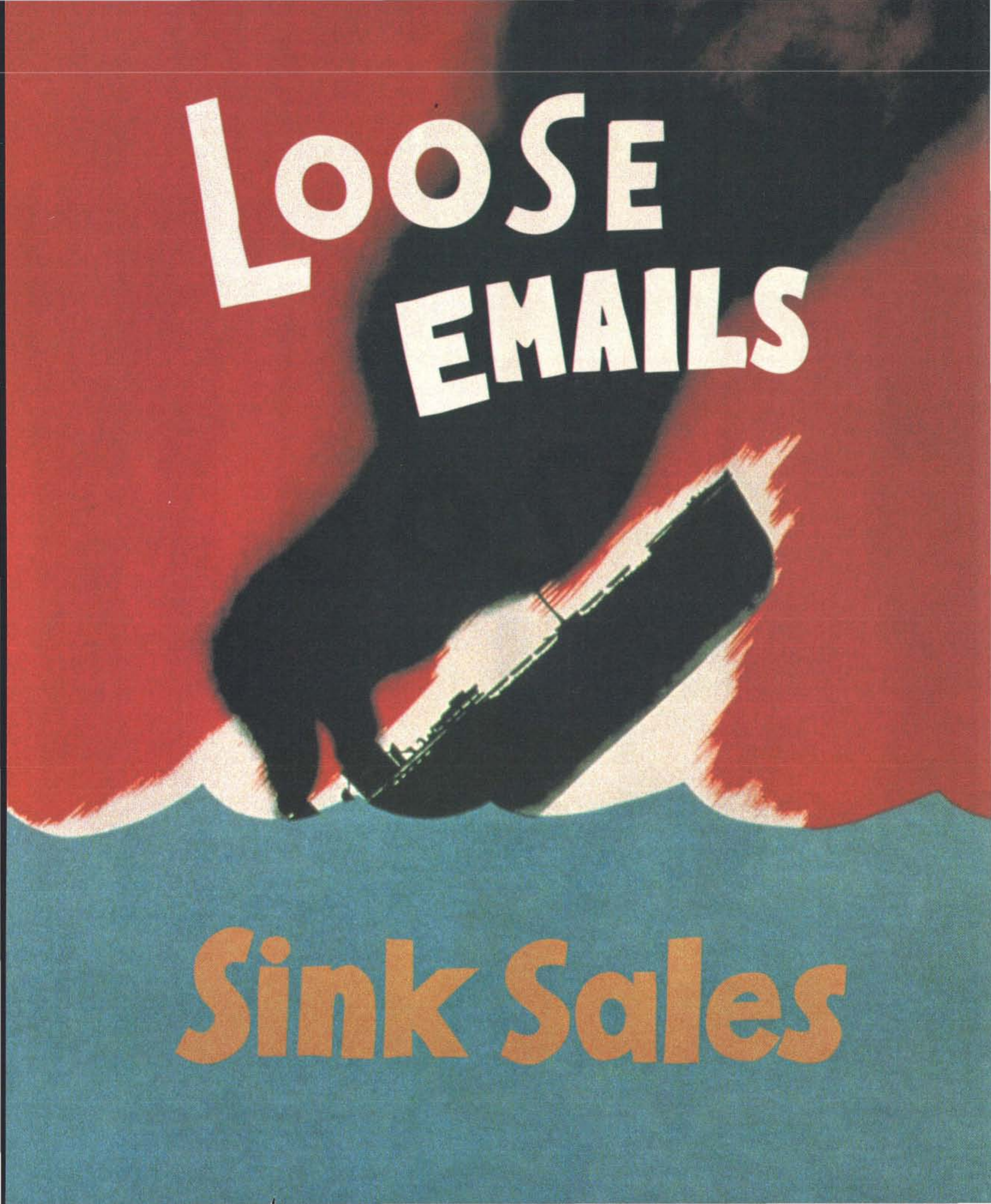
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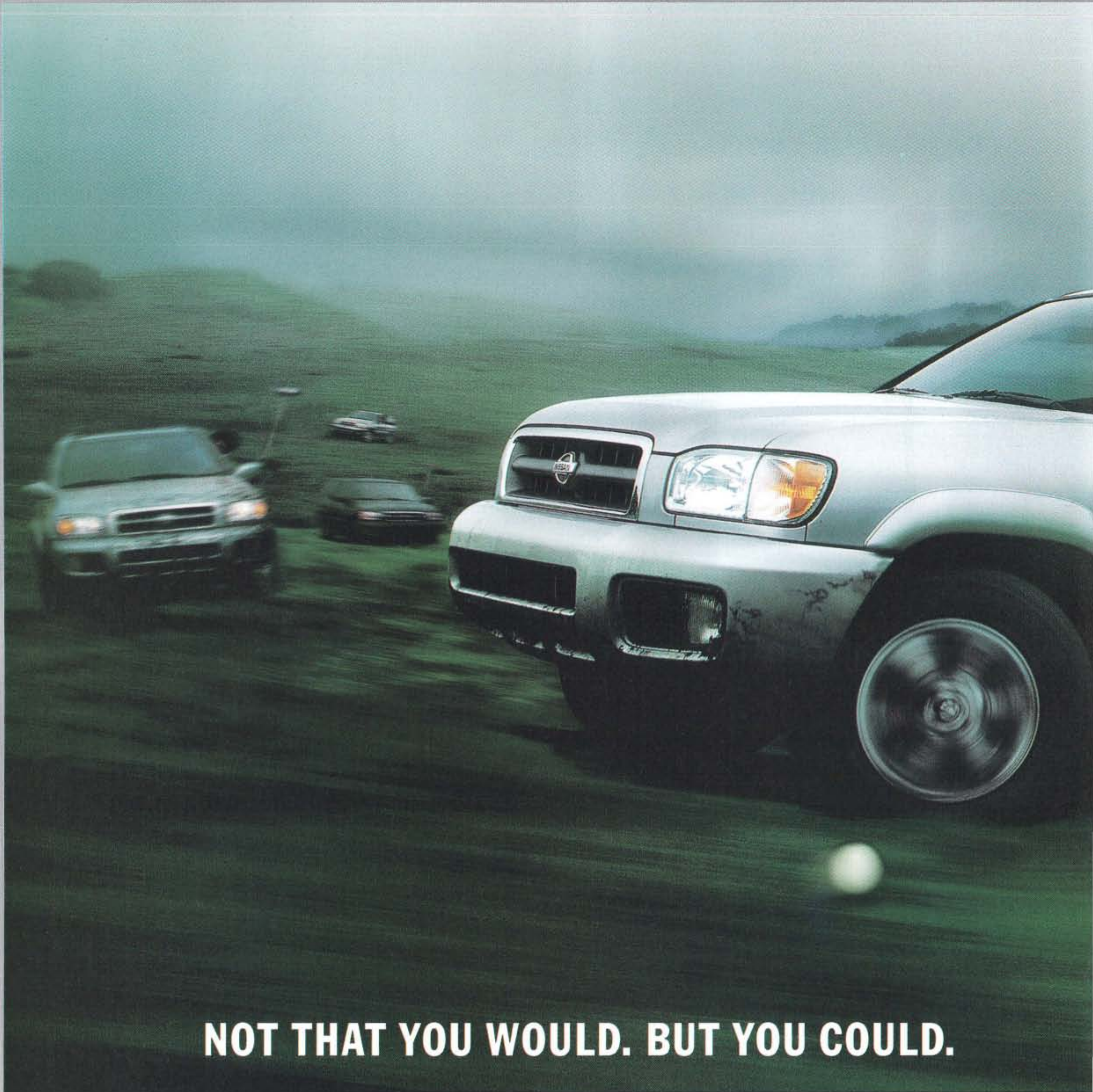

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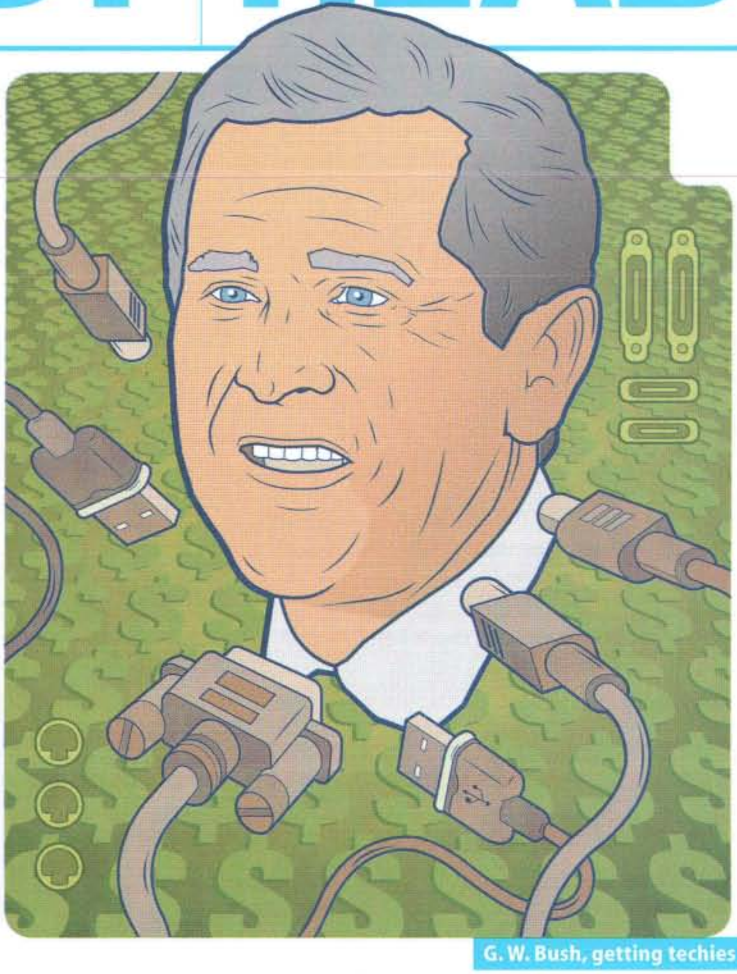
UU-boatNet

WIRELESS A 20-Gbps undersea fiber-optic cable isn't much use when you're cruising in a diesel-powered submarine. In fact, as far as the US Navy is concerned, the most important two-thirds of the planet is unwired – the part beneath the waves. Seawater interferes with electromagnetic signals, and subs usually have to raise an antenna to the surface to send and receive email – hardly a stealth maneuver. But in a recent test, the research sub USS *Dolphin* successfully sent a series of emails from 400 feet deep, the first time a moving vessel at that depth has been able to communicate without giving away its position. The emails were transmitted as sound waves via an acoustical modem developed by Benthos (*www.benthos.com*), a company based in Cape Cod. The acoustic signal, carrying data at up to 2.4 Kbps, reached a buoy where a transducer converted it to radio and beamed it line-of-sight to a ship, which sent it to dry land. The system faces a bigger test during the Seaweb 2001 exercises off the coast of San Diego: The *Dolphin* will cruise through an area seeded with 40 communications nodes to find out whether a continuous signal can be maintained as the sub travels from cell to cell. The military app is clear, but the U-boat Net could also be useful in undersea oil exploration and environmental research.
– *Brian Alexander*



G. W. Bush, getting techies to plug and pay.

Outgeeking Gore

POLITICS OK, so he couldn't name the leader of Pakistan. And he certainly didn't invent the Internet. But Texas governor George W. Bush has no problem identifying the captains of the new economy. On the eve of the Republican National Convention, the Bush campaign is working hard to challenge Al Gore's claim that he's the geeks' candidate of choice. A listing of Bush's Information Technology Advisory Council, a group of prominent tech leaders who have agreed to lend their names and considerable bank accounts to the GOP effort, reads like a Valley who's who: Gordon Moore, Michael Dell, former Netscape CEO Jim Barksdale, Cisco CEO John Chambers, and Oracle president Ray Lane. The Bush group has already won over CNET founder Halsey Minor, who had supported Gore previously.

"We wanted to show there's a deeper cultural affinity between the policy interests of the Bush administration and the policy interests of the new economy," says Margita Thompson, who advised Bush's campaign in California.

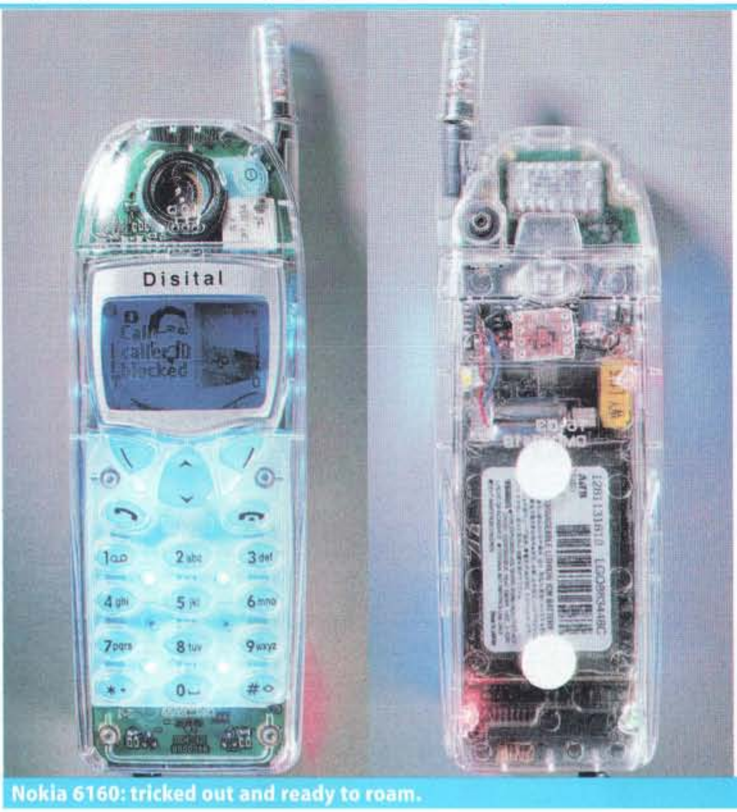
The techies will challenge Gore's positions on tort reform, H.1B visas for foreign workers, and export-control restrictions. The Bushies also plan to call attention to the role that Austin now has as a new economy outpost – Texas has more high tech jobs than any state except California. Bush has criticized the Justice Department for going after Microsoft, but aides say he has no plans to make the DOJ suit a campaign issue.

Gore's backers say they're not concerned about Bush's all-star roster in Silicon Valley. "It would be odd if business executives did not provide significant support for Republicans," says a top Gore adviser. "Gore's devotion to these issues is a career-long pursuit, not just an election campaign gimmick."
– *Karen Breslau*

The New Party Line

HARDWARE Until recently, I was perfectly happy chatting on my standard matte-black Nokia 6160. Then a colleague bought an 8860, the $800 silver "cigarette lighter" phone and heat-seeking status symbol, and it easily outshone my drab workhorse.

I was brooding about this when I stumbled across Tokyo Motor Trenz, a tiny store in San Francisco's Japantown, where you can pick up a couple of microscale plastic Godzillas along with those performance accessories for your Honda Accord. But the real action is at the back counter, where Motor Trenz (*www.tokyomotortrenz.com*) can customize any Nokia 5100- or 6100-series phone. Motor Trenz goes way beyond the familiar snap-on faceplate. Like an automotive chop shop, it dismantles handsets and replaces the works with tricked-out parts - iridescent covers with glow-in-the-dark backs, rainbow-patterned buttons, showy antennas, and souped-up battery packs. One procedure entails putting a "tattoo" - an illustrated little transparency - under the LCD's glass screen. You can choose from thousands of themes - from Pokémon to porno.



Nokia 6160: tricked out and ready to roam.

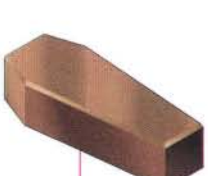
The Trenz techs voided my warranty with a few turns of a #6 Torx wrench, installing a see-through case and matching transparent battery pack with lights that flash like Christmas whenever they sense cell phone activity - even from neighboring phones. I decided that I also had to have a clear antenna (with an internal "laser" LED that shoots a beam of blue light from its tip), a transparent-blue keypad, and some tiny Bruce Lee wallpaper as the tattoo. I'll admit that, once I saw my phone lying cracked open like a patient on an operating table, I got carried away with the circuit-board modifications. George, a guy with a soldering gun, replaced a number of chips and lightbulbs; now the LEDs and buttons that used to be dull green light up in radioactive blue.

These pyrotechnics will cost you: All the cosmetic surgery came to around $300. But now my piece is so over the top it breaks the ice at every party. To hell with high-end phones - my cell rocks true trenz.
- *Adam Fisher*

Productivity per Square Inch Soars!

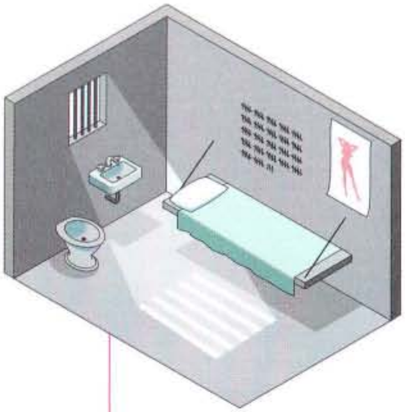
WORKPLACE **Employment may be at a record high these days, but cubicles are getting seriously downsized. With office space scarce and rents on the rise in Silicon Valley and other tech power hubs, the average geek is working in increasingly cramped quarters. Until recently, a standard office enclosure measured 8 feet by 8 feet. These days, suppliers report that they're selling cubes as small as 5 by 6 to tech firms, affording employees a measly 30 square feet of work space. Here's how the slimmed-down office cubicle measures up against other highly circumscribed properties. -** ***Joanna Glasner***

Porta-John toilet
11.7 square feet
$6.43/ft²/month



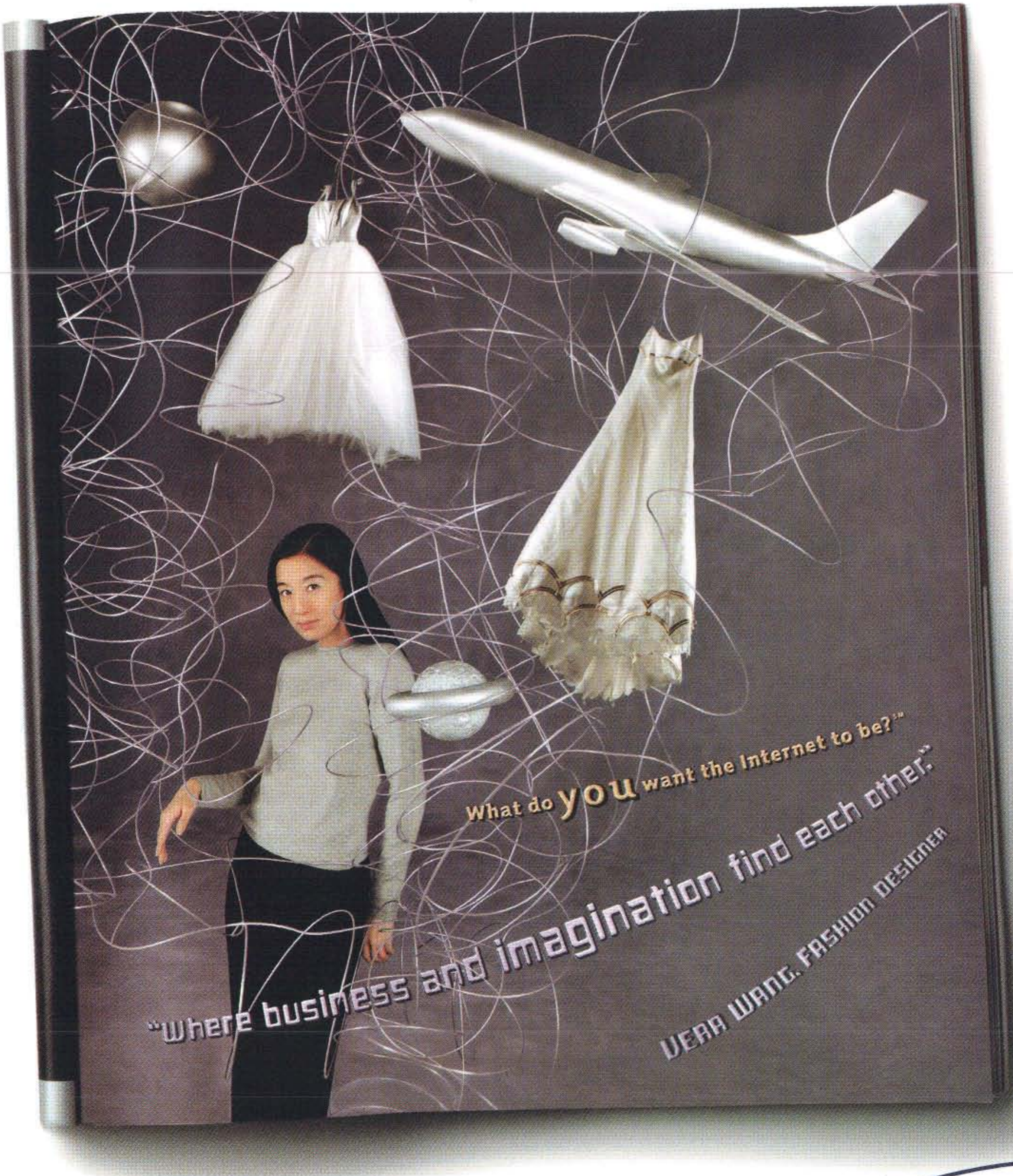
Funeral casket
15.2 square feet
$85.71/ft²

Office cubicle, Silicon Valley
30 square feet
$8/ft²/month



Prison cell, San Quentin
70 square feet
$25.29/ft²/month

PHOTOGRAPHS: WILLIAM FAULKNER; ILLUSTRATION: STEVEN STANKIEWICZ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"Where business and imagination find each other."
Vera Wang, Fashion Designer

eBusiness

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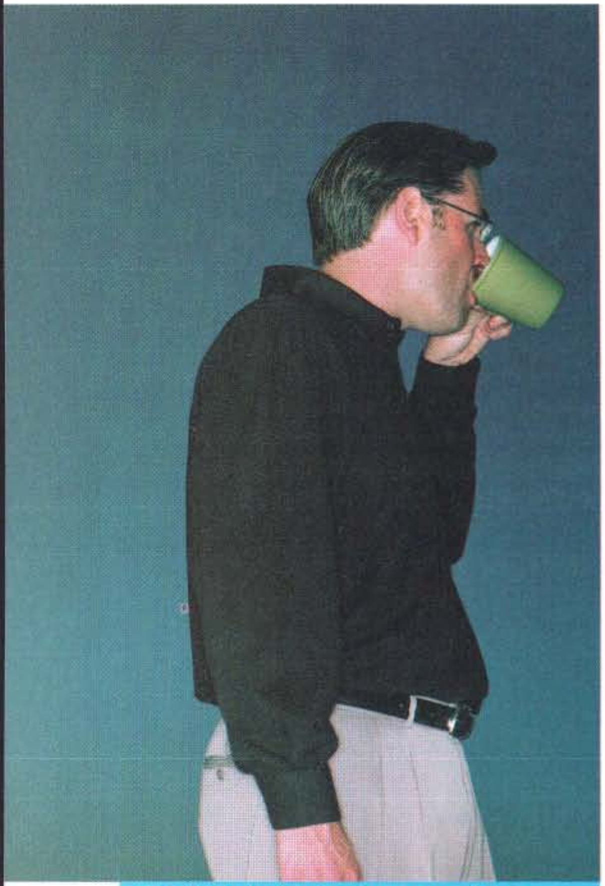
Dot Gone

HORIZONTAL PORTALS Startupfailures.com, a Web site for dotcom flops and other busted ventures, has been drawing about 2,500 visitors a day since it was launched in May. And for good reason: Only 6 of 1,000 business plans get venture funding, and 60 percent of those go bankrupt. The site shares horror stories, lists business opportunities, and offers tips ("Your Failure Feedback"). *Wired* spoke with its creator, Nicholas Hall - who, at age 30, already has three startup failures under his belt. - *Warren Berger*



Nicholas Hall: drinking from failure's cup.

Wired: Is failure a growth industry?

Hall: Yes. And I consider that a very positive answer. It means more people are trying.

What about your failures?

First, I tried to start up a financial services company. And then I was COO of a beverage holding company. We were gonna do the whole microbrew thing when that was all the rage. That was definitely bad timing. The last one was an Internet startup. We ran out of money. I've learned a lot of lessons.

What's the key to bouncing back?

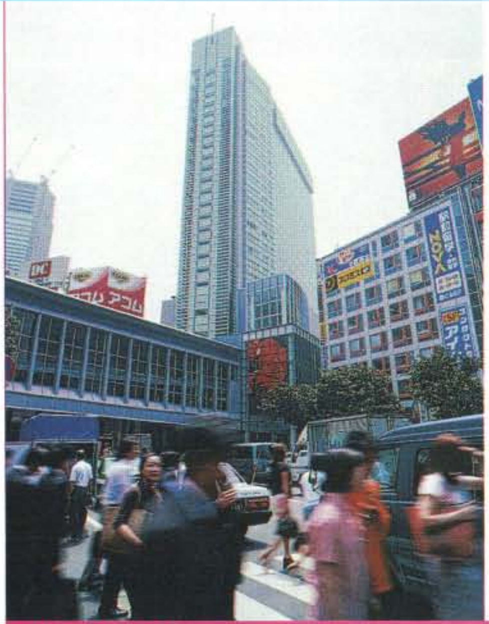
Have a compelling vision for your life, so you don't have time to worry about yesterday. When I closed out my last startup, it took me maybe an hour to bounce back. I think there's a tendency for people to feel a bit jaded by the experience, especially if they haven't been through it as many times as someone like myself. I understand that "business failure" is not about me. But even with that perspective, at the moment you realize something you tried didn't work, it kind of sucks.

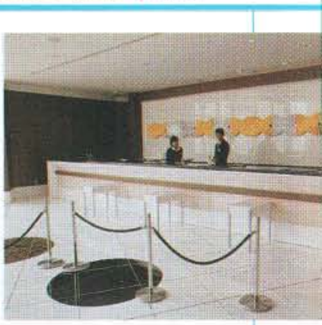
How will the site help people whose startups have tanked?

One thing we're going to do is give visitors a chance to share their failure stories, and we'll pick the best, the Failure of the Week. It lets people share what they went through, so others can get value out of that.

But what if Startupfailures.com fails?

As long as I can afford the monthly Internet maintenance, I'll keep it going. And if it fails, I'll try again. You can count on that.





MEATSPACE

Tekka Mecca

In the heart of Tokyo's Shibuya district – ground zero of Japan's dotcom boom – the latest hangout is the Excel Hotel Tokyu.

The West Tower of the 25-story glass-and-steel Shibuya Mark City complex houses NTT Electronics, game-software giant Konami, and incubator Sun-Bridge Venture Habitat, run by former Oracle Japan head Allen Miner.

Just across a mezzanine-level bridge, the adjoining hotel artfully caters to the needs of entrepreneurs on the go, with each of the 120 rooms designated for business travelers boasting a 10-Mbps Net connection. If your laptop doesn't make it through customs, the front desk will loan you an NEC notebook. Pay phones scattered throughout the hotel feature IR ports that let you connect your handheld. Even the hotel's toilets are high tech: The seats are electrically warmed, and a timely spray of water offers users back end support. The hotel's rooms feature ultramodern furnishings set in a decor as simple as an ikebana flower arrangement – a calming respite from the traffic and neon mayhem outside. Two floors of the hotel are female-only, with beefed-up security, and all guests receive Japanese yukata robes for lounging.

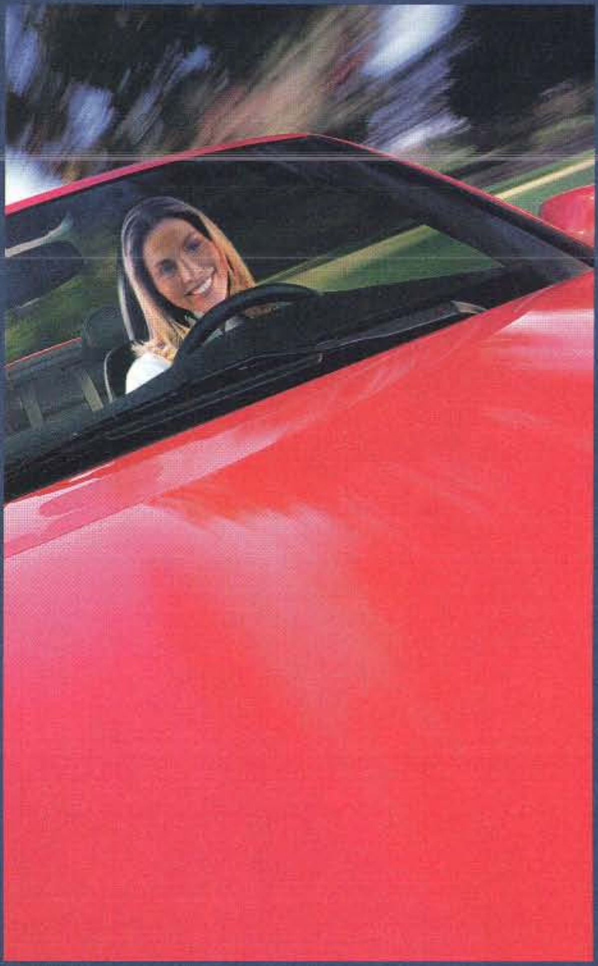
When you're ready to power lunch, duck out to the nearby Kaikaya for Euro-Japanese fusion seafood in a lively atmosphere of capitalist decadence. It's a favorite haunt of dealmakers, where the drink of choice is a frosty Kirin lager: Building Japan's infobahn can work up a mighty thirst.
– *Daniel Scuka*

Shibuya Excel Hotel Tokyu: 1-12-2 Dogenzaka, Shibuya-ku, Tokyo, Japan. +81 (3) 5457 0109, *www.tokyu.co.jp/inn*. Single standard room: $145.

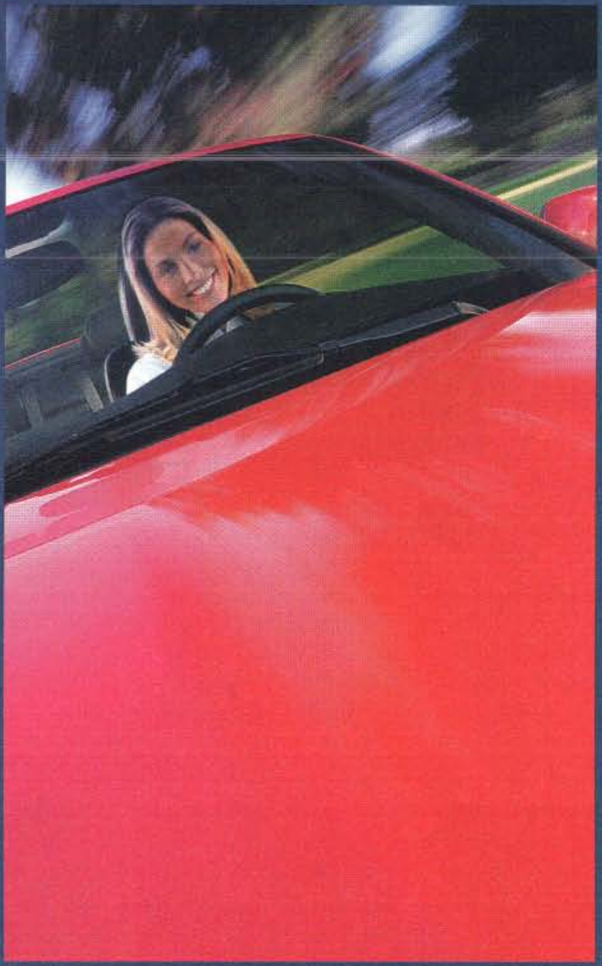
Kaikaya: 23-7 Maruyama-cho, Shibuya-ku, Tokyo, Japan. +81 (3) 3770 0878. Open daily; last call at 11 pm.

PHOTOGRAPHS FROM LEFT: NICHOLAS ZURCHER; JUN TAKAGI

Sarah



Sarah's Insurance Agent



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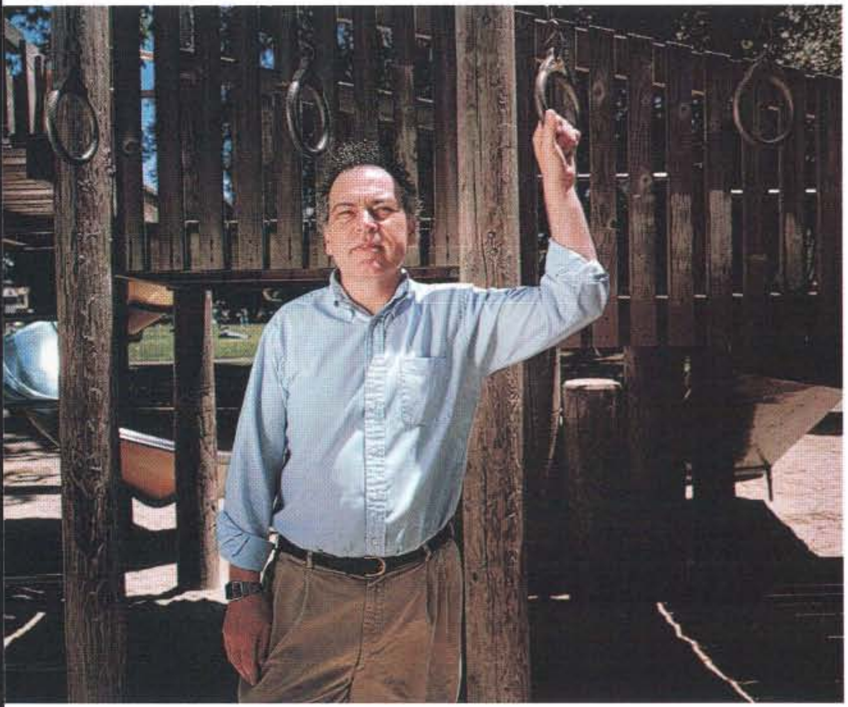
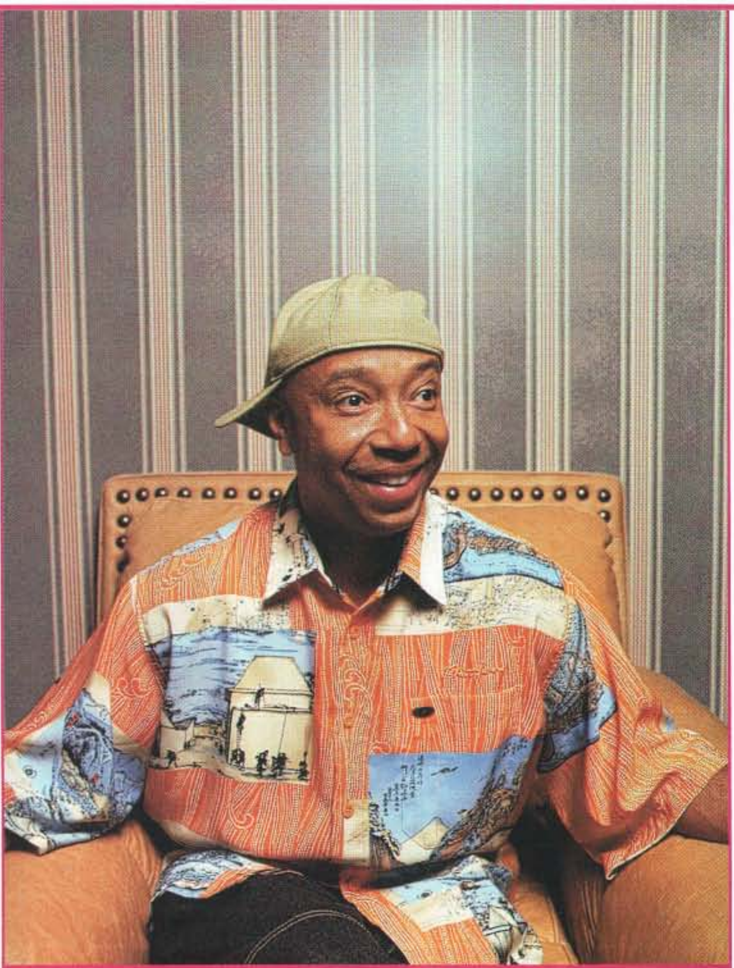
leads the world in TV watching among preteen girls, with 47 percent of 11-year-olds in front of the tube four or more hours per day (World Health Organization) → US ecommerce sites lost



Reeducator

"There's this public perception that if you ain't got computers, you ain't got jack," says **William L. Rukeyser**, director of the nonprofit Learning in the Real World (*www.realworld.org*). Though the government is shelling out millions of dollars to put PCs in schools, the onetime senior adviser to the California Department of Education says we're not adequately testing whether all this technology is leading to academic gains. To remedy this situation, Learning in the Real World currently funds four university research projects investigating the impact of technology in the classroom. Rukeyser isn't part of a PC backlash – he just believes tech is being sold as a cure-all. "Are computers the best way to spend a school's resources?" asks Rukeyser. "We want to make sure someone is asking the important skeptical questions." – *Jennifer Hillner*



Hi Def Politics

Russell Simmons, pioneering hip-hopreneur and cofounder of the Def Jam label, is adding some bytes to his bark. Simmons' recently launched urban portal, 360HipHop.com, offers the now-standard music and lifestyle content along with ecommerce from Phat Farm, his clothing line. So what sets 360HipHop apart? Its decidedly political bent. The site's Rap the Vote initiative – the hip hop answer to Rock the Vote – encourages young adults to go to the polls this November. By tying that message to politically charged lyrics, Simmons hopes the site will enlighten while it entertains. Which presidential candidate does Simmons favor? "We don't necessarily endorse candidates," he says. "We just know that most hip hoppers don't want to fuck with Bush." – *Adrienne Day*

Hand-to-Hand Combat

Handspring CEO **Donna Dubinsky** wants to turn her company's mighty little organizer into a full-featured handheld computer. And just in time – Microsoft's Pocket PC is gunning to become the do-it-all mobile platform of choice. Rather than bulk up, Dubinsky says Handspring's Visor will stay streamlined and inexpensive, relying on snap-on hardware modules to add wireless services and multimedia. A history of serial success is on her side: Dubinsky helped resurrect the stillborn PDA market with 3Com's PalmPilot in 1997, grabbed a third of that market with Handspring this year, then aimed for a midyear IPO. Despite the track record, she downplays her role: "I don't make anything, I don't invent anything, I don't sell anything." But apparently, she knows how to organize. – *Paul Boutin*

PHOTOGRAPHS CLOCKWISE FROM TOP LEFT: STACY KRANITZ; ANNE SENSTAD; ROBERT GUMPERT

Must See VC

"Tech companies will go public. The kids will diddle with laptops in the garage. Mom and Pop will get in on an IPO." That's writer-producer Michael Chernuchin's snapshot of *Bull,* his TV series about a brash investment firm riding the new economy wave. (The first episode airs August 15 on TNT.) It's taken the former *Law & Order* producer 10 years to sell execs on a drama that doesn't feature cops, lawyers, or doctors. But now that Wall Street is within reach of anyone with Web access, Chernuchin aims to make phrases like "sell short" as well known as *ER*'s "stat!" And while the show will have its share of cringe-inducing burn rates, the only freely flowing red you'll see is the ink on the bottom line. "No dead bodies," Chernuchin says. "At least none dead from violence." – *Jennifer Hillner*

PHOTOGRAPH: MICHAEL LEWIS

JARGON WATCH

Dot Snot

An arrogant young dotcom executive inflated by the ease with which he or she has become wealthy.

Nap Lounge

Workplace area with recliners and cots for employees to take brief midday naps, inspired by recent studies suggesting that 40 winks during the workday can improve productivity.

Virtual Season

The online continuation of a canceled TV show. Fans organize a team of amateur producers and writers and post new episodes in teleplay form, often at the same day and time as the original program.

Margin of Prevarication

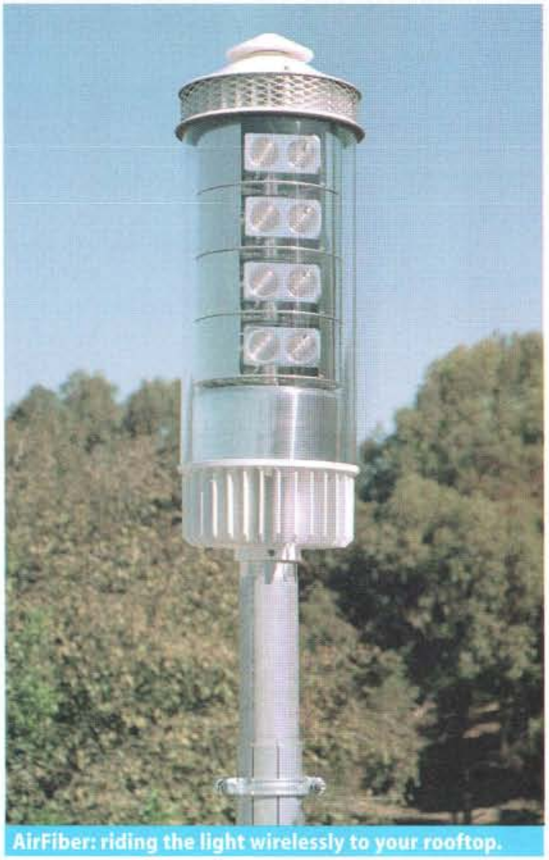
Formula for measuring the degree to which one has to exaggerate a product's value to close a sale. Defined as $MP = (p - a)/p$ where p is the inflated value and a is the actual value. If you say that a product has a value to your customer of $12 million when it's really worth $3 million, the MP is 0.75.

Tip o' the WWI campaign hat to Paul McFedries and Joe Ashbrook Nickell.

– Gareth Branwyn
(jargon@wired.com)

622-Mbps Laser Tag

BROADBAND Will lasers solve the "last mile" problem of bringing high-speed access to dense urban areas? San Diego-based AirFiber (*www.airfiber.com*) is betting on it. The company is debuting OptiMesh, a wireless optical network of rooftop nodes that will beam gigabytes of information across the sky using lasers carrying near-infrared light. The service will compete with large players such as TeraBeam (backed by Lucent Technologies), which plans to offer its own high-speed optical network directly to businesses rather than to carriers, as AirFiber is doing. AirFiber begins shipping its equipment to telecom customers next month, after two years spent developing a network of lasers and rooftop transceivers.


AirFiber: riding the light wirelessly to your rooftop.

Currently, less than 5 percent of buildings in US urban areas have fiber access to high-speed data networks, and installation costs run $50,000 to $250,000 per building. By comparison, the AirFiber system can be installed for about $20,000 in a matter of days. "We wanted to make it cheap enough so that every carrier would want it," says AirFiber cofounder and CEO Jim Dunn. AirFiber has kept costs down by cobbling together a transceiver of off-the-shelf parts. The laser, for example, is the kind used in read-write CD players, while the motor that aligns the beam was made to swivel rearview mirrors. The focusing lens comes from a Polaroid.

AirFiber's birdhouse-sized nodes are mounted on building rooftops. Each node is linked via laser to as many as four neighbors, forming a mesh network. The laser waves beam voice, data, and multimedia at speeds up to 622 Mbps, about 400 times faster than a T1 line. If one of the links goes down – say, if a bird flies in front of a beam – the system automatically routes the signal to another node. The redundant system of nodes, the company says, is more reliable than TeraBeam's window-mounted antennas.

Nortel Networks has taken a strategic equity investment in AirFiber, suggesting that the big boys are convinced that optical networks will become a major broadband player.

"It's like processing speed and memory," says Dunn. "There's no such thing as having too much bandwidth." *– Michael Menduno*

Trojan Horse Troubleshooter

INTELLIGENT AGENTS Where computer users see system glitches, executives at Santa Clara, California-based Aveo (*www.aveo.com*) see opportunity.

CEO and founder Paul Hurley has built the company on an algorithm that sniffs out and alerts you to potential conflicts on a PC before they cause trouble. The company provides a free client, Attune, that compares your applications, plug-ins, and drivers with a master database of problems. When you install software known to conflict with another program, Attune dings you with an Intelligram – an email containing route-around instructions. "We're adding 10,000 people a day, and within the next 12 months we should be on 50 million machines," Hurley says. "The growth rate for the system is exponential."

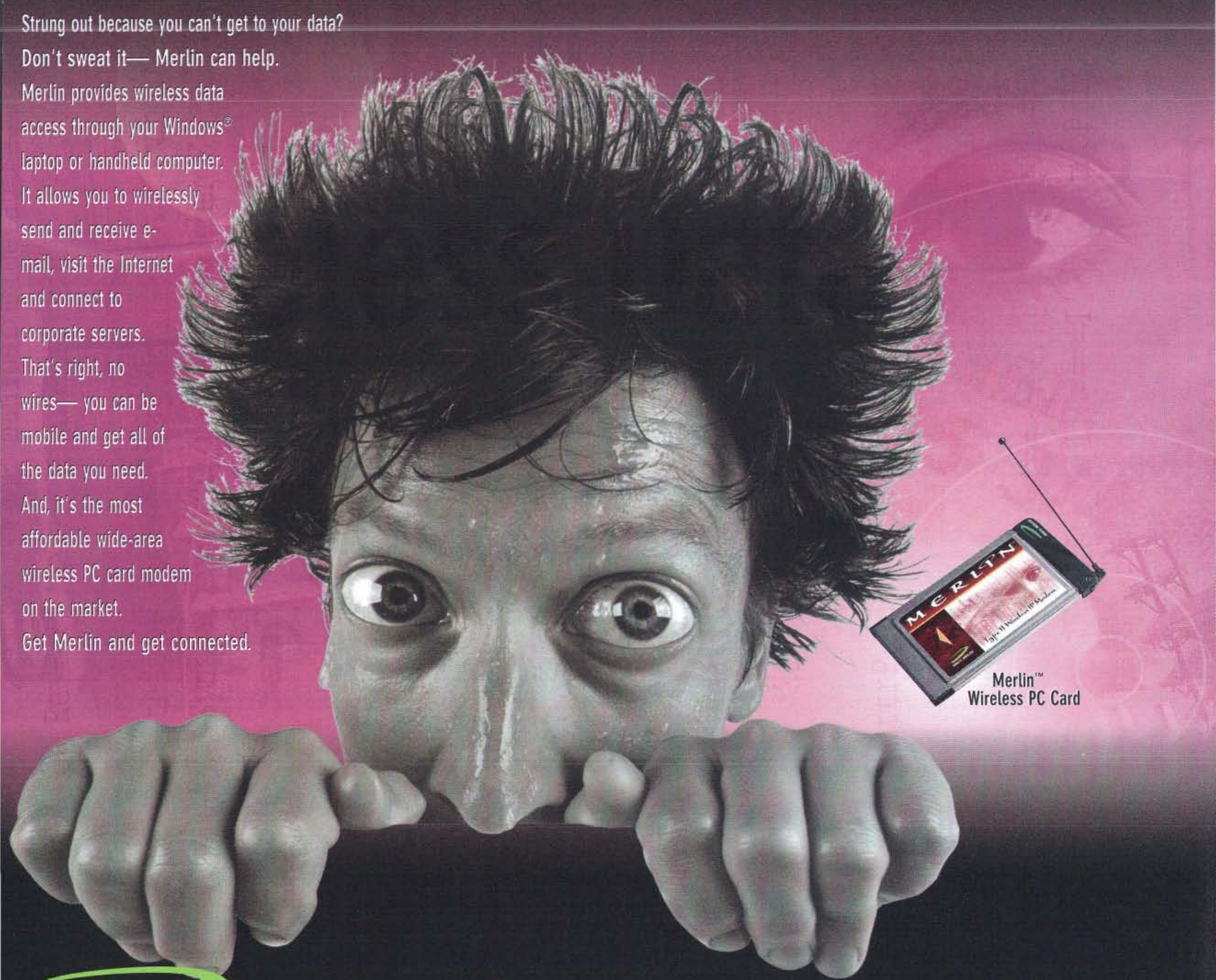
Aveo collects fees from partners such as Dell, HP, and 3Com, which bundle Attune with their products to reduce customer-support costs. But it's not just preemptive tech support that has clients excited: The application doubles as a kind of stealth marketer. For example, because Attune can monitor the ink in your printer, Hewlett-Packard floats an offer for a replacement cartridge just when the ink is running low. Aveo execs, who have dubbed this idea of tech-support-related commerce "t-commerce," say that timely offers like HP's replacement cartridge are seeing buy rates as high as 11 percent. "We show up only when users have a need, because we know how they're using their PCs," says Aveo VP Brian Burch.

Having an intelligent client closely monitoring users' hardware and software does raise privacy concerns, though Hurley notes that all Attune-related data is housed on the user's PC and that Intelligrams are triggered only after cross-checks for conflicts or upgrades are done locally.

Still, with privacy, perception is reality. "There's potential for tremendous misuse," says Aaron Goldberg, principal analyst at Ziff-Davis. "But there's also a tremendous opportunity if they handle things right." *– Jeffrey M. O'Brien*

PHOTOGRAPH: JIM FERRARI

Wireless Data Fix?



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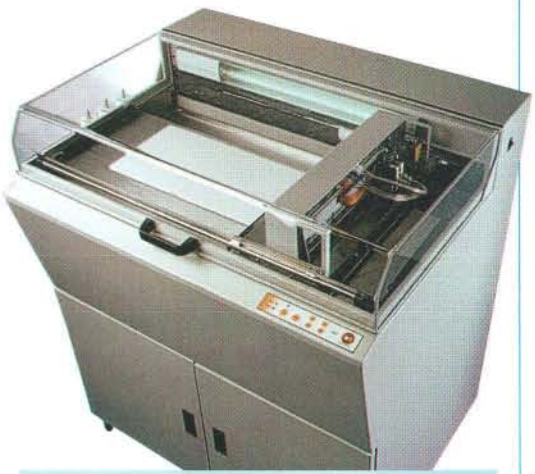
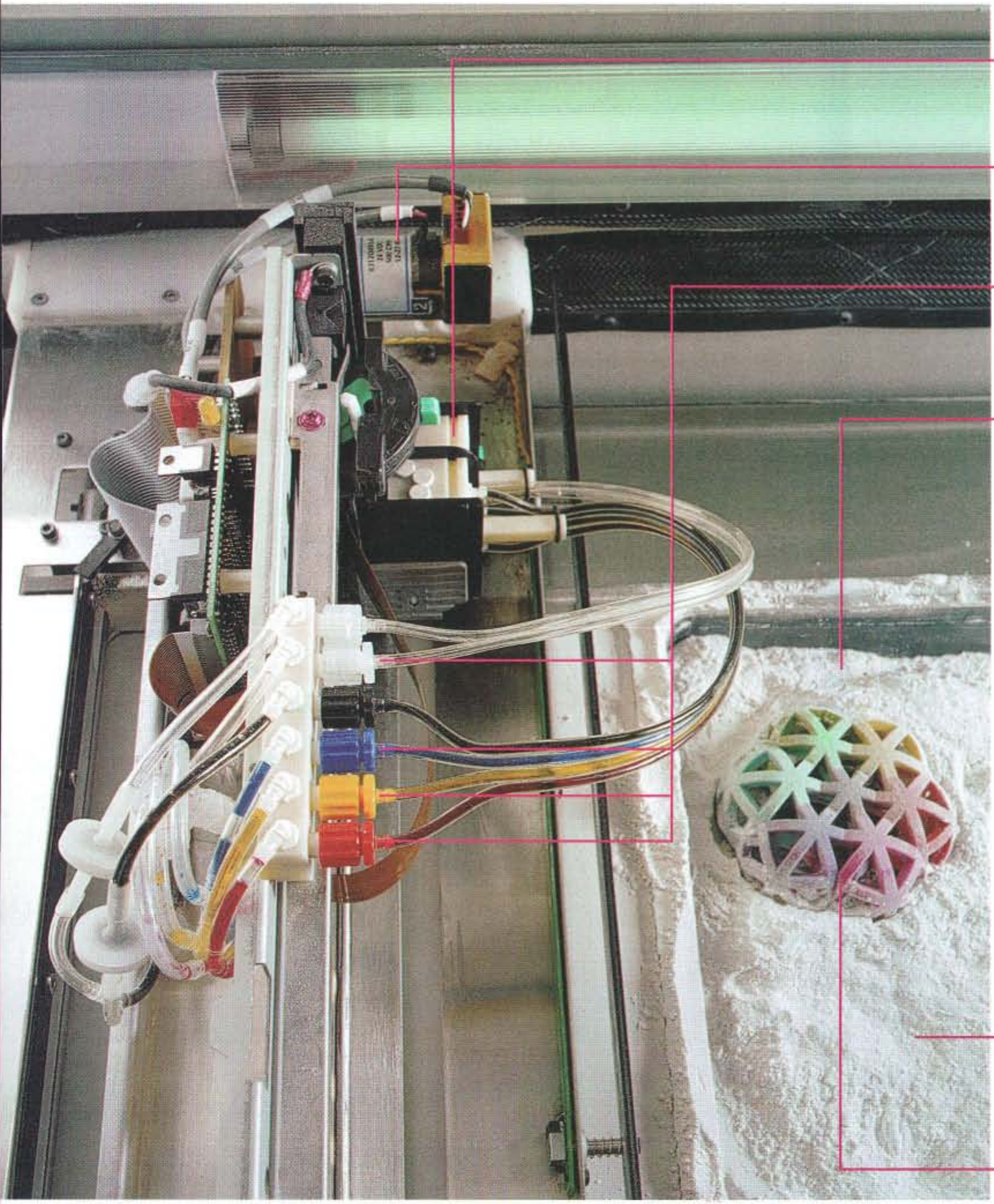
Demo or Dye

UNDER THE HOOD
BY DAVID PESCOVITZ

Color cues are helpful if you're piecing together the prototype for a next-gen handheld computer, but they're absolutely key if you're modeling the molecular structure of a new cancer drug. So with a dash of food coloring, Z Corporation has expanded the applications of its 3-D printer from monochromatic rapid prototyping into vibrant, full-color scientific visualization. Developed with support from Riken, a Japanese scientific research institute, the Z402C 3D Color Printer makes physical the multicolored digital data of chemical models, structural analyses, and anatomical representations by fusing together micro layers of building powder with a water-based binder solution laced with magenta, yellow, and cyan dye. The $67,000 photocopier-sized box can whip up a candy-colored contraption of almost any shape in less than a day.



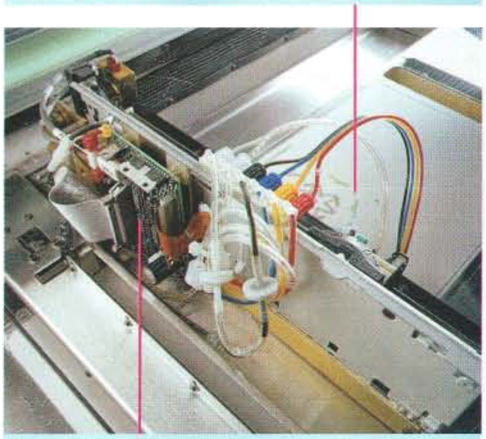


Bringing 80-nanogram droplets of binder solution to a boil, the inkjet printhead squirts a focused spray of steam bubbles out of 160 pinpoint holes 6,000 times per second.

A DC motor drives the printhead back and forth over the build bed.

Water-based binder solution – magenta, yellow, cyan, and a dye-free clear for white areas – is pumped into the manifold. The dyes can be blended into eight hues; a palette of 6 million colors is on the horizon.

The spray of binder solution causes particles of the building powder, primarily plaster, to stick together and "print" one layer of the object.



The printer's driver card processes the control signals from an onboard 266-MHz PC running proprietary code.

After one layer is printed, the build bed automatically lowers, and a mechanical roller (not shown) spreads a fresh layer of building powder across the surface of the object. Each cross section is only four one-thousandths of an inch thick and takes nearly a minute to print.

The completed demo has the slightly ceramic texture of a stale cookie.

PHOTOGRAPHS: CHRISTOPHER HARTING

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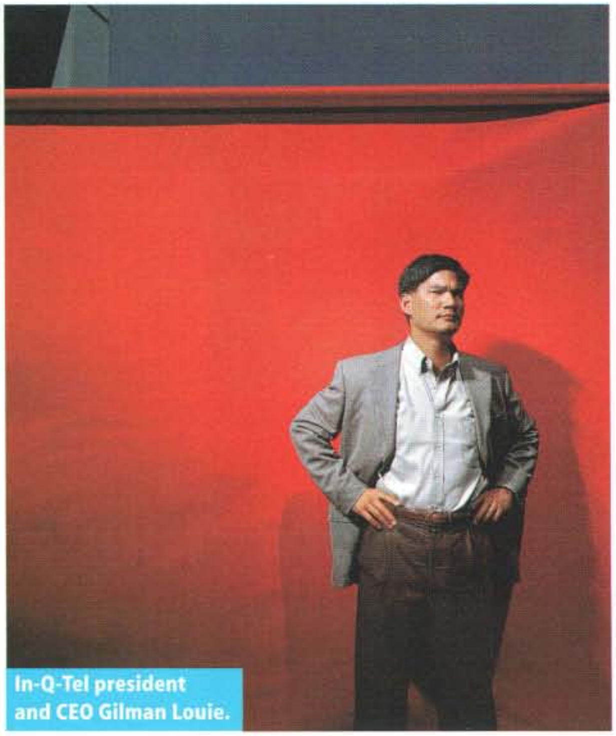
The Spy Who Funded Me

VENTURE CAPITAL Last year, when the CIA announced it was creating its own high tech VC company, a chorus of snickers rose from Silicon Valley. Since then, In-Q-Tel (formerly In-Q-It) signed Gilman Louie – a former Hasbro Interactive executive with a tech background – as president and CEO in September, got its budget upped $6 million for next year, and has inked 10 deals in the US. *Wired* caught up with the G-man VC on the subjects of Internet privacy, shopping CIA money in the Valley, and having Uncle Sam as a boss. – *Evan Ratliff*



In-Q-Tel president and CEO Gilman Louie.

Wired: What kind of reaction are you getting from the Valley?

Louie: I would say that, in almost every single case, the Valley has been completely receptive to us. I have not had one meeting in the Valley where somebody said, "Gilman, this is the craziest notion. Get the hell out of my office, I don't want the CIA in my business." If a 15-year-old can launch a denial-of-service attack and students from overseas can create viruses, imagine what would happen if a nation-state decided to launch a full-scale attack on our information infrastructure. In the Valley, most people get this.

Do you have any success stories so far?

There are two we think have a high potential for success. One is netEraser, which uses a completely different approach to protecting information across the Internet. It's not totally reliant on encryption, so even if you were to use sniffers, you might pick off pieces of the information – but you'd never get all of the information together.

The second one is Graviton, which is a very low-cost microsensor technology based on MEMS. The technology can sense particles and fluids in the air, and transmit that information wirelessly. Instead of a $60,000 airport bomb-detection device the size of a file cabinet, there could be a smaller and cheaper device.

Some of your technologies enhance online privacy. Doesn't that conflict with the CIA's other objectives?

There are two aspects of information security: There's government being able to read it, and government being able to protect it. In our case, we live in the space between the commercial world and the governmental world, and the government has just as much a need to protect its information. Without that capability, the CIA, as well as the rest of the federal institutions, could be brought to their knees.

Is there a clearly defined line between surveillance technologies and commercial ones?

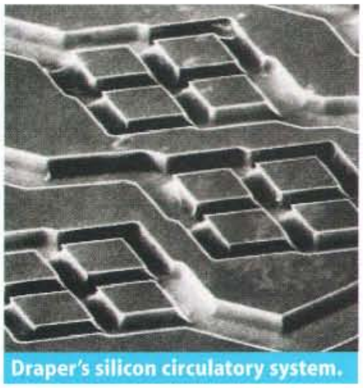
There has to be. You can't take a company public that focuses on spying. There's no commercial value – or no legal one – so we only operate in areas with commercial opportunities, which means that they're going to be defensive.

Why the change from In-Q-It to In-Q-Tel?

Scott Cook [Intuit chair] came up to me at a conference and said, "You know, Gilman, 'In-Q-It' sounds a lot like 'Intuit.' Most people who buy Intuit products don't necessarily think the world of the federal government." And I said, "Got it. Not a big deal." Scott was pretty funny about it.

The Organ Chip

BIOENGINEERING The organ donor shortage has become a critical problem as transplant waiting lists grow longer. Each year, fewer than 10 percent of the 40,000 or so Americans who need a new heart get one. But instead of recruiting more organ donors, why not grow new organs? That's what a team at the Draper Laboratory in Cambridge, Massachusetts, is working to do, by creating a rudimentary circulatory system on a silicon chip. Working under the direction of Joseph Vacanti, a surgeon and tissue engineering researcher at Massachusetts General Hospital, the lab microfabricates a system that may one day lead to producing a functioning human organ.



Draper's silicon circulatory system.

Tissue engineers have been able to grow the cells of complex organs in the laboratory for some time. But getting those cells to assemble themselves into functioning kidney or liver tissue has proved elusive, because organs require lots of plumbing – capillaries, arteries, and veins – to deliver nutrient-rich blood and to remove wastes.

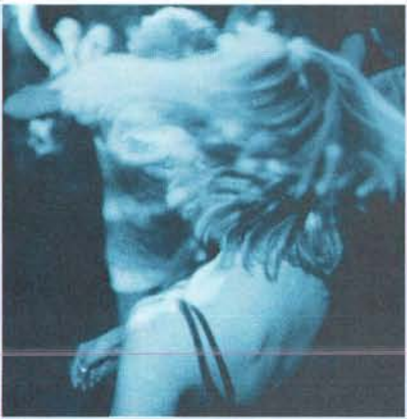
The Draper Lab's circulatory-system-on-a-chip creates a crude version of that vital plumbing. The team used photolithography to etch a pattern of arteries, veins, and capillaries 10 to 20 microns deep onto 4-inch-diameter silicon wafers. Tissue engineers then seeded the chip with cells taken from the lung of a rat. The cells grew to coat the etched pattern, forming a network of blood vessels. The eventual goal is to create a biodegradable structure that would be implanted into a patient. After the structure degraded, it would leave behind a three-dimensional scaffolding upon which new tissue could grow that mimics the functions of an organ.

The next step for the Draper team is to place successive layers of liver cells onto this circulatory system until it has built a multilayer "wedding cake" of blood vessels and liver cells. Draper hopes to be able to use this technique to generate a complex human organ within a decade.

– *Brian Alexander*

PHOTOGRAPHS FROM TOP: THOMAS BROENING; JEFFREY BORENSTEIN AND JOSEPH RICKER

www.riohome.com



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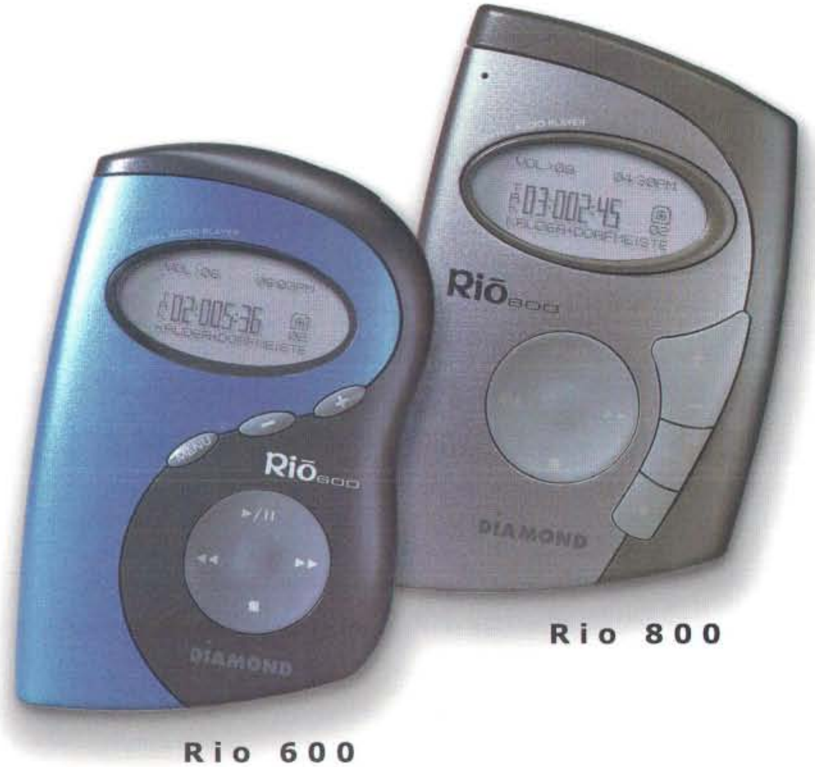

Rio 800

Rio 600

Rio

DIGITAL AUDIO PLAYER

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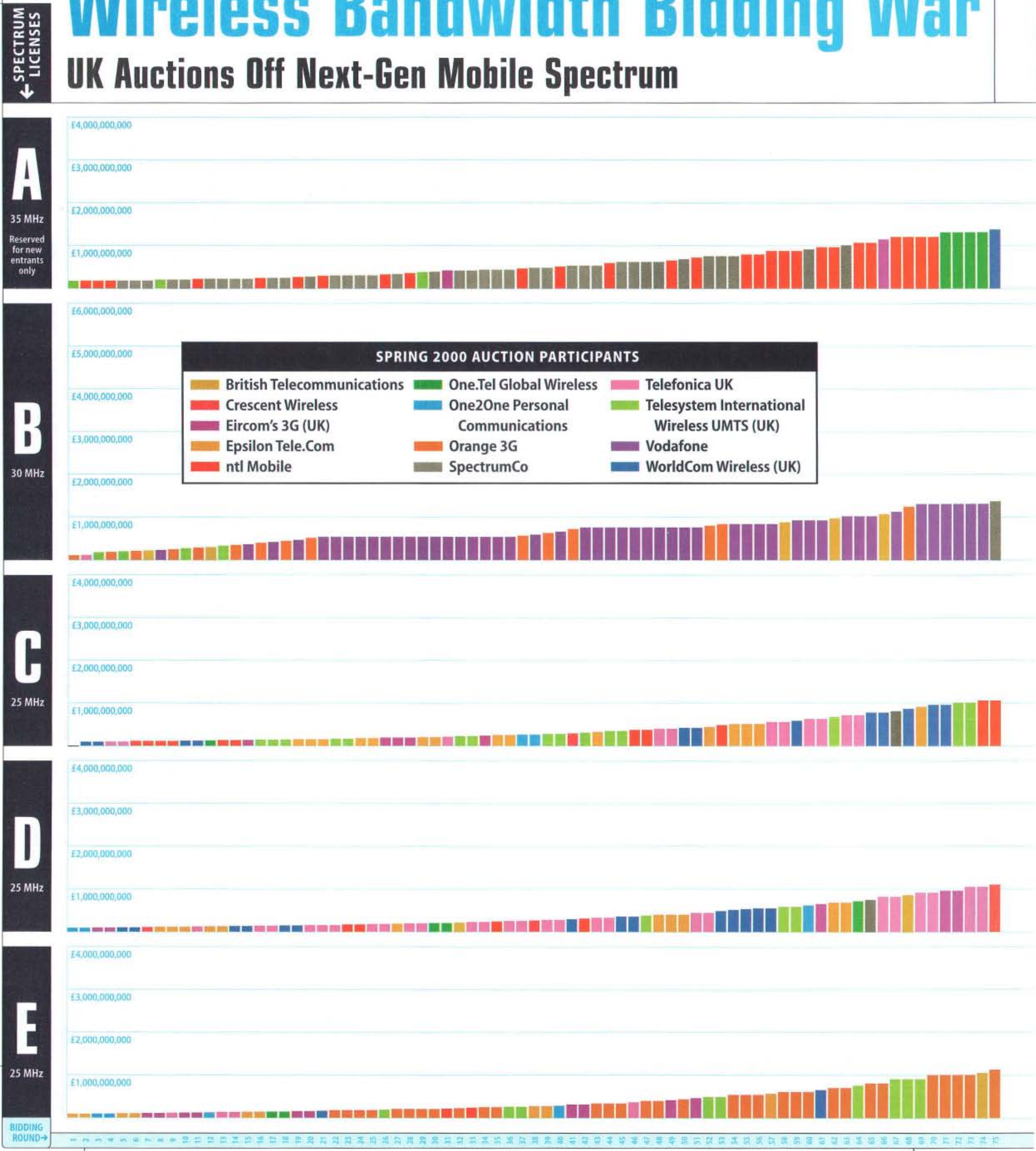
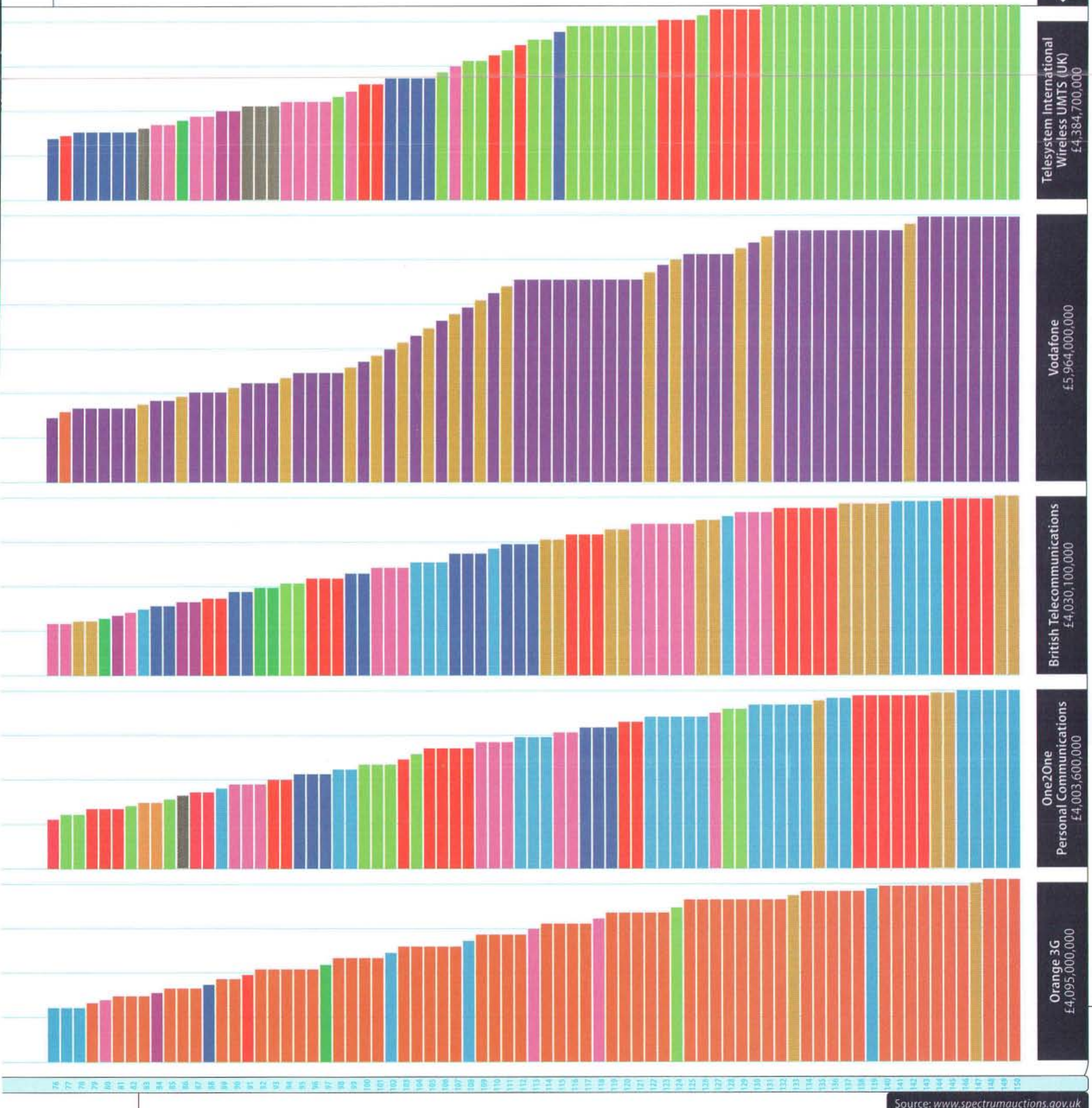
Wireless Bandwidth Bidding War

UK Auctions Off Next-Gen Mobile Spectrum

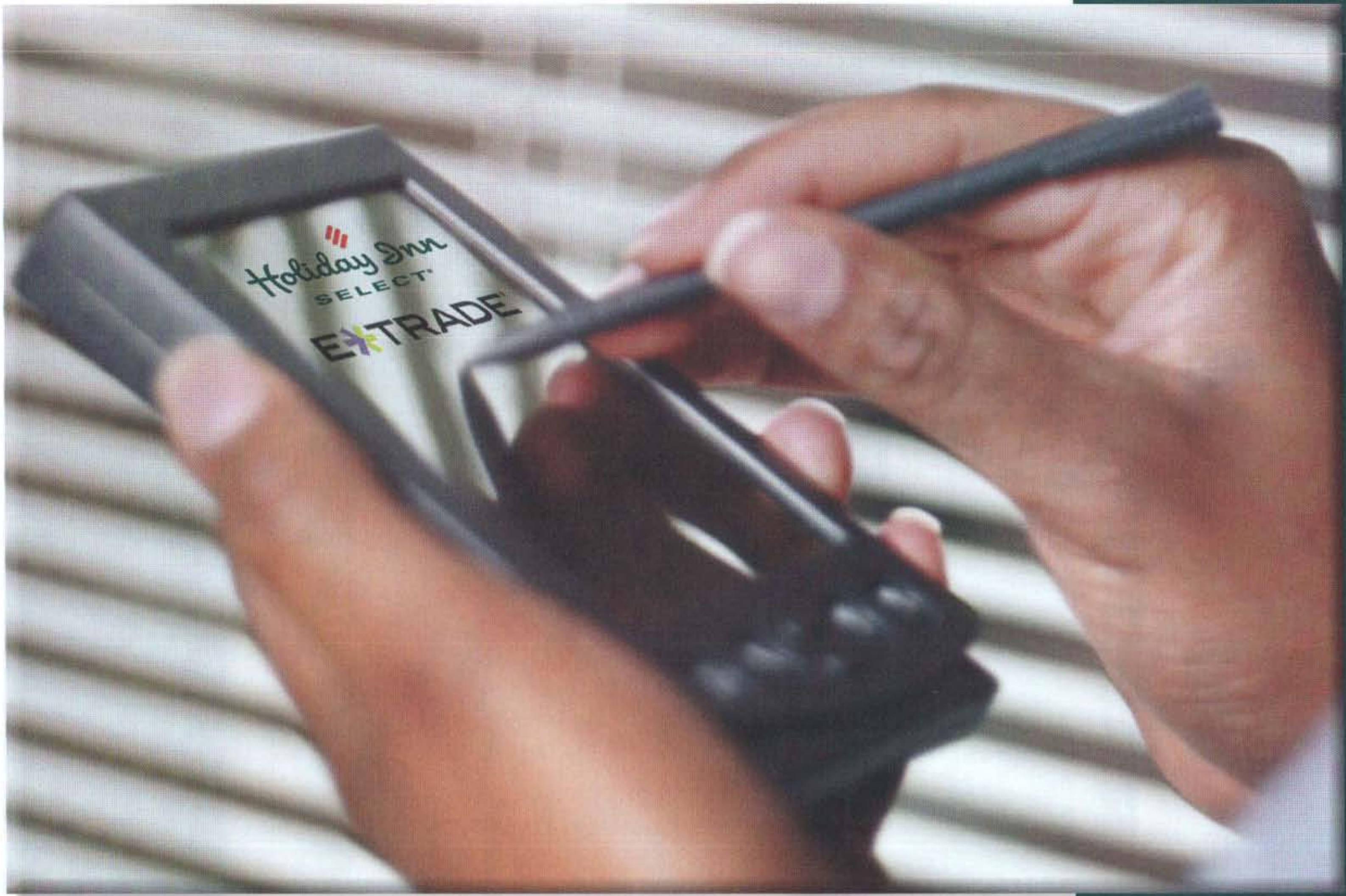


When the UK government began auctioning off 140 MHz of bandwidth for third-generation, or 3G, mobile appliances this spring, it had no idea of the economic forces it was unleashing in the mcommerce melee that ensued.

Thirteen companies entered the auction. The new spectrum was divided into five licenses, A through E, with A reserved for new entrants. Players could bid on only one license per round. License B, the second largest block (30 MHz), is more desirable than licenses C, D, and E, so industry leader Vodafone concentrated its bids exclusively on B, sending a strong "we will never be beaten" message. Newcomers tended to be more crafty: When pushed off license A by a higher bid, for example, a contender would frequently spend a few rounds bidding up licenses C, D, and E until they had increased in value enough to make A seem undervalued. Then the contender would move back to A. All the jockeying paid off – for the government. A staggering £22.5 billion (about US$33.25 billion) was paid for the five licenses, more than ten times the amount expected. – *Oliver Morton*



Source: *www.spectrumauctions.gov.uk*



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Borderless Economy

US Tech Firms' Global Footprint

"Where do you want to go today?" is not a rhetorical question: The long arm of Redmond reaches far beyond US shores, farther even than General Motors, which has sales, manufacturing, or business offices in 52 nations worldwide. Microsoft's tally: 63 countries and territories. Other tech sector leaders – Cisco (networking equipment), Dell (computer hardware), Lucent (telecom gear), and Amgen (biotech) – are playing catch-up, with one exception. Motorola's wireless web extends into 74 different lands, including Sri Lanka and Uzbekistan. – *Jennifer Hillner*

Sources: IDC (*www.idc.com*), Hoover's Online (*www.hoovers.com*), Microsoft (*www.microsoft.com/presspass/fastfacts.asp*), Amgen (*www.amgen.com/contactinfo.htm*), Lucent (*www.lucent.com/intl/locator.cgi*), Dell (*www.dell.com/us/en/gen/corporate/factpack_003.htm*), Motorola (*global.motorola.com/location/default.asp*), Cisco (*www.cisco.com/public/countries_languages.shtml*), General Motors (*www.gm.com/company/international/*)

Company		Total countries
AMGEN	🟧	21
CISCO	🟪	57
DELL	🟨	35
LUCENT	🟦	56
MICROSOFT	🟥	63
MOTOROLA	🟩	74

Argentina	🟪 🟦🟥🟩
Australia	🟧🟪🟨🟦🟥🟩
Austria	🟧🟪🟨 🟥🟩
Bahrain	🟦
Bangladesh	🟩
Belarus	🟩
Belgium	🟧🟪🟨🟦🟥🟩
Bolivia	🟩
Brazil	🟪🟨🟦🟥🟩
Brunei	🟦
Bulgaria	🟪
Cambodia	🟩
Canada	🟧🟪🟨🟦🟥🟩
Chile	🟪🟨🟦🟥🟩
China	🟧🟪🟨🟦🟥🟩
Colombia	🟪🟨🟦🟥🟩
Costa Rica	🟪 🟦🟥🟩
Croatia	🟪
Czech Republic	🟪🟨🟦🟥🟩
Denmark	🟧🟪🟨 🟥🟩
Dominican Republic	🟦🟥🟩
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El Salvador	🟦
Egypt	🟪 🟦🟥🟩
Finland	🟧🟪🟨🟦🟥🟩
France	🟧🟪🟨🟦🟥🟩
Georgia	🟩
Germany	🟧🟪🟨🟦🟥🟩
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Guam	🟩
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Hungary	🟪 🟦🟥🟩
India	🟪🟨🟦🟥🟩
Indonesia	🟪 🟦🟥🟩
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Israel	🟧🟪 🟦🟥🟩
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Mexico	🟪🟨🟦🟥🟩
Morocco	🟥🟩
Netherlands	🟧🟪🟨🟦🟥🟩
New Zealand	🟪🟨🟦🟥🟩
Nicaragua	🟦
North Korea	🟪 🟦🟥🟩
Norway	🟪🟨 🟥🟩
Pakistan	🟥🟩
Panama	🟦🟥
Peru	🟪 🟦🟥🟩
Philippines	🟪 🟦🟥🟩
Poland	🟪🟨🟦🟥🟩
Portugal	🟧🟪 🟦🟥🟩
Puerto Rico	🟧 🟦🟥🟩
Romania	🟪 🟩
Russia (CIS)	🟪 🟦🟥🟩
Saudi Arabia	🟪 🟦🟥🟩
Singapore	🟪🟨🟦🟥🟩
Slovakia	🟪 🟦🟥🟩
Slovenia	🟪 🟥
South Africa	🟪🟨🟦🟥🟩
South Korea	🟨 🟩
Spain	🟧🟪🟨🟦🟥🟩
Sri Lanka	🟩
Sweden	🟧🟪🟨🟦🟥🟩
Switzerland	🟧🟪🟨🟦🟥🟩
Taiwan	🟪🟨🟦🟥🟩
Thailand	🟪🟨🟦🟥🟩
Trinidad	🟥
Turkey	🟪 🟥🟩
Ukraine	🟪 🟦 🟩
UK (England, Northern Ireland, Scotland, Wales)	🟧🟪🟨🟦🟥🟩
United Arab Emirates	🟪🟨🟦🟥🟩
Uruguay	🟥🟩
US	🟧🟪🟨🟦🟥🟩
Uzbekistan	🟩
Venezuela	🟪 🟦🟥🟩
Vietnam	🟥🟩

Heard the One About the Rocket Car?

Hasn't everyone? Now meet the guy who says he lit the fuse.

Editor's note: Wired *found the following tale posted on the Web, originally at a site called cardhouse.com. According to its author, the story has garnered thousands of emails, some filled with praise, others with doubt, delight, sympathy, or suspicion. After a series of cagey communications with the writer, we reprint the piece here in the spirit of "all of the above."*

Fast Foreword

The first thing you should know about the Legend of the Rocket Car is that it's been around longer than most people think. It started years ago, as a vague rumor passed from one guy to the next by word of mouth, usually in bars or during lunch-break bullshit sessions. The kind of story someone hears from a friend who read it in a magazine a long time ago. It's a story that comes out of nowhere, gets passed around for a while, then dies out. And whenever it flickers back to life, it seems to spread like a grass fire. I used to think it was funny how it managed to spread so fast purely by word of mouth, but now that it's become a subject of Internet interest, its popularity is downright spooky.

If you've never heard the legend before, here are the bare bones of it: Once upon a time, in some out-of-the-way part of the country (take your pick of locations), a maniac took a rocket of some sort and mounted it on the back of a car (make and model depend on the automotive trends when the story is told). The maniac then sped down a deserted stretch of highway, and when he reached an appropriate spot, lit the rocket (which was either a JATO bottle, a surplus ICBM engine, or an experimental shuttle booster). The car reached an incredible speed in a matter of seconds (somewhere between 150 miles per hour and warp 9) at which point the brakes and steering became ... ineffective. This development would've been bad enough on a straightaway, but through some error in planning or navigation,

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the maniac found himself hurtling toward a sharp curve. When the car hit the curve, pilot and car flew like an arrow (for a distance limited only by the imagination of the person telling the story), before crashing into an inconveniently placed mountainside.

Nifty.

I'm sure this sounds pretty ridiculous if it's the first time you've heard the Legend of the Rocket Car, but that's because I didn't go out of my way to make it sound good. Most people try to make the story convincing, embellishing it with all sorts of facts and details to make it easier to swallow. I've personally heard a dozen versions over the past 20 years, and I'm amazed at how the story grows, shrinks, and generally mutates with each retelling.

I'm sure I notice these changes more than most people. I'm not a car expert or an aerospace engineer or anything, and I really don't have much interest in urban legends. Even if I did, from an intellectual point of view, this story isn't as entertaining as some of the others that have come and gone. The one about McDonald's shoveling worms into the grinders that produce Big Macs, for instance, beats it by a mile. I only pay attention to the rocket car legend because I'm 99 percent sure that I started the whole thing in the spring of 1978.

Now, before you draw any conclusions, I don't want you to get the impression that I, myself, claim to be the maniac who drove the rocket car into the wild blue yonder. I'm saying I was probably *responsible* for the rumor, not that I actually performed the test flight. As far as I know, the flight in question never happened. Like all legends, some basics of the story are true, but once the tale started circulating, the truth was lost in the embellishments. If the Legend of the Rocket Car survives, my great-grandchildren will probably end up talking about a guy from Lunartown who nailed an antimatter pod onto an old Apollo moonrover and flew into the side of Tycho Crater.

That's how it goes with legends.

But like I said, I'm not a rocket scientist or a motorhead. I'm a high school biology teacher. And the fact that I'm a biology teacher is relevant to the extent that it's responsible for my writing this story down.

Two years ago, a week or so before Thanksgiving, I was taking my class through some of the particulars of evolution ("How human beings were raised from monkeys," as one of my students phrased it). We were discussing Charles Darwin and *The Origin of Species* when one of my students asked me how Darwin's research ship ever got the name HMS *Beagle*.

Since I've been teaching this subject for 11 years, it's rare when a student asks a question I can't answer. But this one was a real pisser. Anyone who's ever taught in a classroom knows that sometimes you get a student who likes to play Stump the Teacher - a kid who asks questions he doesn't really care about, just to see if he can find a gap in the teacher's knowledge. Usually these questions are pretty easy to evade or ignore, but sometimes one will catch my interest. This was one of the latter. So I told the student I had no idea where the ship's name came from, but I'd find out.

Ha. I couldn't find the answer *anywhere*. My reference books concerned themselves with headier subjects - the Scopes trial, genetic mutations - than the name of Darwin's boat. I looked through every book I could find, but came up dry. After exhausting all my research options, I was thinking about conceding this particular round of Stump the Teacher when one of my kids asked if I'd looked for the information on the World Wide Web.

I said, "Of course I looked there. It's the first thing I checked. Go play in traffic."

Truth be told, I not only *hadn't* checked the Web, I didn't know *how* to check it. In addition to being a non-rocket scientist, I'm not (or at least I wasn't) very interested in computers or the Internet in 1998. I know this is a shameful thing for a teacher to say, but it's true. I kept *meaning* to take a look at the Internet-connected computers in the school library, just to see what all the hoo-ha was about, but I simply hadn't gotten around to it. So the next day I went to the library during my free period and asked the librarian for help, feeling like Crocodile Dundee asking how to work the bidet. The librarian had obviously dealt with the situation before. She gave me her 10-minute "Internet for Stupid Teachers" course, and as soon as she left me alone with Netscape and a search engine, I typed "Darwin" in the space provided.

When the results of my search started filling the screen, the first thing I noticed was that there were more than 2 *million* sites listed as Darwin-related. The second thing I noticed was that *none* of them seemed to pertain to Charles Darwin, the most famous naturalist in history. Instead, they all seemed to focus on the Darwin Award, an honor (posthumously) bestowed on people who've done the most good for humanity by removing themselves from the communal gene pool.

I don't have much interest in **urban legends**. I only pay attention to the rocket car story because I'm **99 percent sure** I started the whole thing.

This was my very first encounter with the story of the rocket car in writing - a description of a 1995 Darwin Award winner.

> The Arizona Highway Patrol came upon a pile of smoldering metal embedded into the side of a cliff rising above the road at the apex of a curve....
>
> It seems that a former Air Force sergeant had somehow got hold of a JATO unit (or Jet Assisted Take-Off) that is used to give heavy military transport planes an extra "push" for taking off from short airfields. He had driven his Chevy Impala out into the desert and found a long, straight stretch of road. Then he attached the JATO unit to his car, jumped in, got up some speed, and fired off the JATO!
>
> The facts as best could be determined are that the operator of the 1967 Impala hit JATO ignition at a distance of approximately 3.9 miles from the crash site. This

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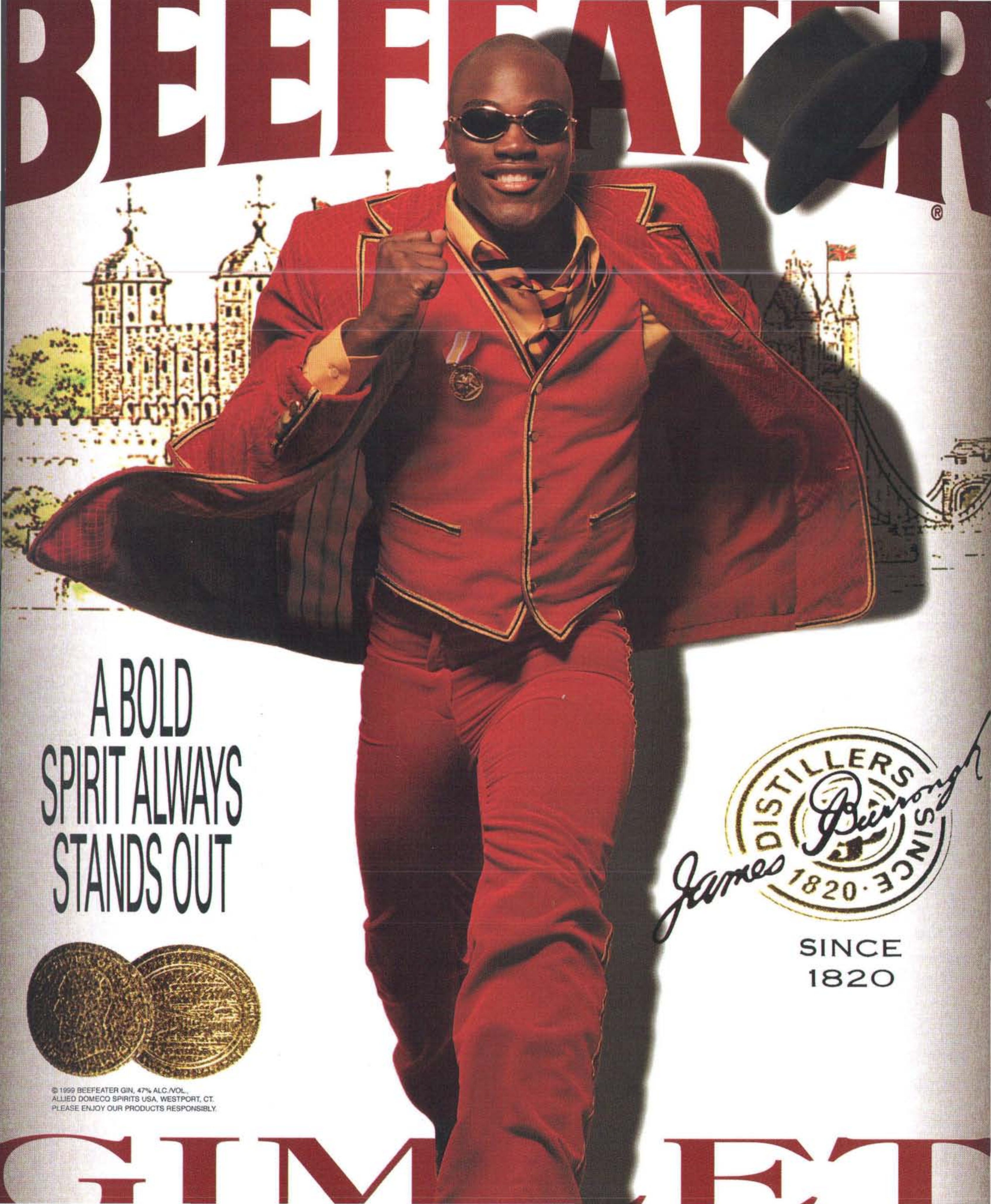
The author, who goes by the name John Pelligrino (carinthecliff@hotmail.com), *describes himself as a high school biology teacher who is married and has two kids.*



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> was established by the location of a prominently scorched and melted strip of asphalt. The Impala quickly reached speeds well in excess of 350 mph and continued at full power for an additional 20 to 25 seconds. The soon-to-be-pilot experienced g-forces usually reserved for dogfighting F-14 jocks under full afterburners. The automobile remained on the straight highway for about 2.6 miles (15 to 20 seconds) before the driver applied the brakes, completely melting them, blowing the tires and leaving thick rubber marks on the road surface. The vehicle became airborne for an additional 1.3 miles and impacted the cliff face at a height of 125 feet leaving a blackened crater 3 feet deep in the rock.
>
> Most of the driver's remains were not recoverable; however, small fragments of bone, teeth, and hair were extracted from the crater, and fingernail and bone shards were removed from a piece of debris believed to be a portion of the steering wheel.

As I said earlier, I'd heard plenty of stories like this. But the Darwin Award version was different. It was chock-full of numbers and specifics, which is always bad news for a legend. Oh, initially it might make the story more believable, but throwing in a lot of facts and figures also gives the nonbelievers plenty of details they can use to refute the story. In the case of the Darwin Award version, I'm surprised that anyone, anywhere, believed the story well enough to repeat it. Ask yourself this, for instance: If this story is true, why has nobody ever produced pictures of the crash site? And how about the unfortunate "pilot"? Nobody was ever able to attach a name to this person?

If you want to explain these questions away by blaming human error or police indifference or whatever, that's OK. But if you look at the physics of the story, you'll see that the whole pile of bullshit is impossible, regardless of the human angle. For instance, when the Chevy left the road with its rocket still going full blast, why did it go in a straight line? Mount a big rocket on a '67 Chevy and it *may* go straight as long as it's on the ground. But once it got airborne, the weight of the engine would immediately pull the nose down. And if the JATO was still blazing away, the car would drill itself into the ground like a tent spike before it got 50 feet from the ignition site.

But the real question about this insane tale is simpler than all that. The real question is, How did such a story ever get started in the first place?

We never **bought a pile** of army surplus and ended up with a crate of M-16s. But once in a while we *did* end up with stuff we **weren't supposed to have**.

Just Desert

When my friends and I set out to build the vehicle we test-fired in the spring of 1978, a real-life, jet-powered, road-traveling car was exactly what we had in mind. Craig Breedlove was busy breaking land speed records in the *Spirit of America*, Evel Knievel had graduated from "biker" to "payload" while attempting to jump the Snake River Canyon a few years earlier. And rocket-powered vehicles were a pretty popular notion. Unfortunately, machines like those required a lot of time and money and engineering skill to build and operate.

My friends and I had none of the above.

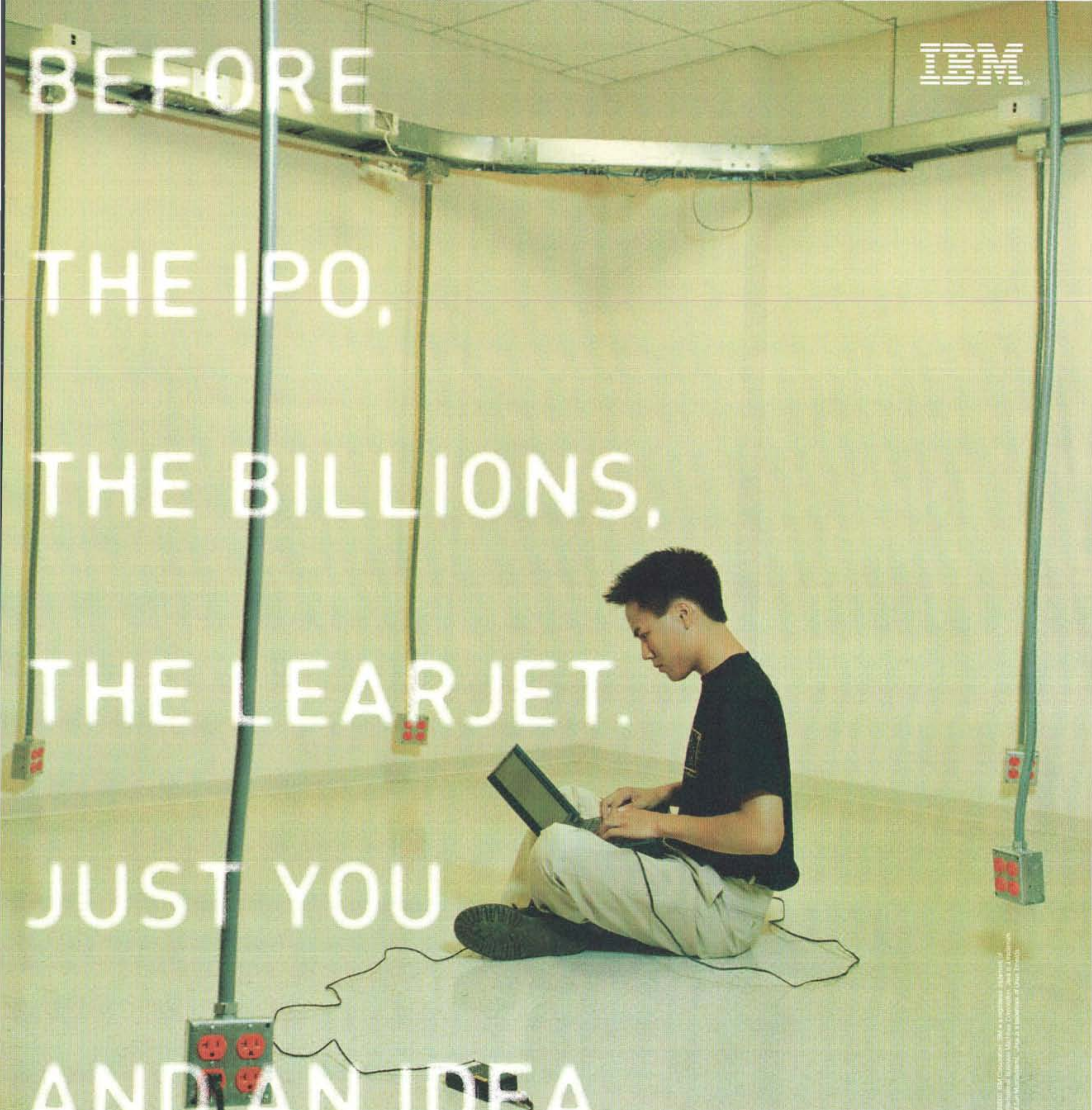
In 1978, I was 22 years old and still living with my parents, in a place I won't specify except to say it was somewhere in the desert. My father owned a scrapyard, 22 acres of barren scrub ideally suited to having junk thrown on it. To be brutally honest, the main yard looked like a cross between *Sanford and Son* and *Apocalypse Now*. The yard was a salvage smorgasbord, covered with everything from dead water heaters to junked airplane cockpits. And since we lived near a major US Army storage facility, a lot of the scrap my father bought and sold came from government auctions. He would go to the auctions held at the post from time to time, bid on premarked lots of God-only-knew-what, then send me out the next day with the big flatbed to collect his latest purchase.

Plenty of people who went to these auctions ended up with nothing more than tons of unusable junk that was worth less than they paid for it. The lots for sale were usually measured by the ton, and if a lot had a few items you were interested in, you had to buy the whole mess. But my dad always seemed to find the lots that contained valuable stuff. He also knew plenty of people who owned military surplus stores and had some idea of what was in demand and what wasn't. Still, he ended up with an amazing amount of unusable military surplus, things like gas masks and vehicle parts that were worthless in the civilian world.

And from time to time, we also ended up with weapons. No, we never bought a pile of crap and ended up with a crate full of M-16s or a Shrike missile. But every once in a while we *did* end up with stuff we weren't supposed to have.

The army had a very strict policy toward scrap dealers who found munitions: You had to give them back. No two ways about it. Before even being allowed to place a bid, dealers at an auction were required to sign several forms, one of which stated that they'd return any "explosive, ordnance, fuse, detonator, or other chemically viable part or assembly of a weapons system." I remember that paragraph well, since it's the only part of the army red tape that ever directly pertained to me. The penalties for noncompliance outlined at the end of the paragraph sounded pretty scary (five-figure fines, possible imprisonment, et cetera), and were enough to make my dad return the smoke grenades I once found in a crate marked HEATER ASSEMBLY, though not the blank M-60 rounds he'd found once himself. These he judged too trivial to warrant a drive to the base, and he kept them as decoration draped over a file cabinet in his office.

Of course I'm telling you this because it's how I managed to get hold of the JATO bottle we used for our rocket car. Actually there were four of them, each one lying in its own long, hay-filled crate with BARREL ASSEMBLY stenciled on the side. Even though I didn't know what the hell they were at first glance, I knew they weren't *barrels* for anything. The JATO bottles were



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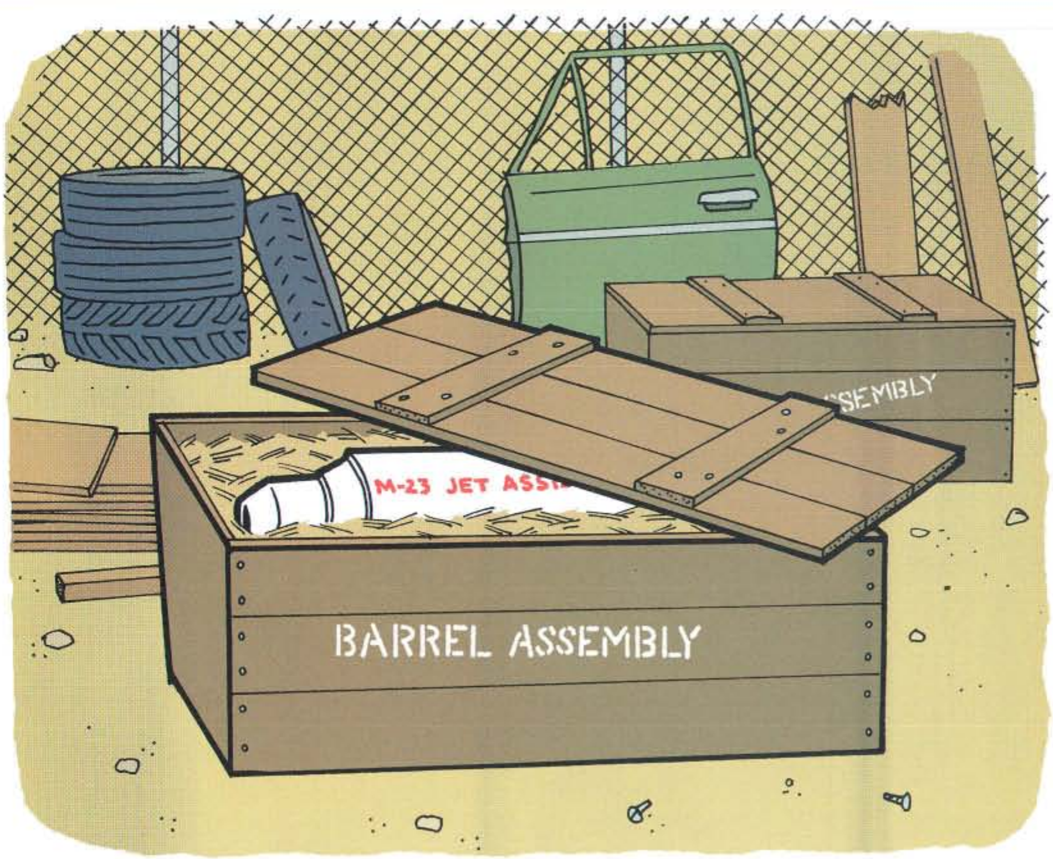


"There were four of them, each one lying in its own long, hay-filled crate with BARREL ASSEMBLY stenciled on the side."

round metal cylinders about 4 feet long, and less than a foot in diameter. Painted on the sides in red were the words M-23 JET ASSEMBLY UNIT. And rather than the sort of valve assembly you'd see on a gas cylinder, the ends of the bottles had an inverted funnel shape to them, with a rubber plug at the funnel's bottom. They were obviously rockets of some sort. And judging from their weight - it took two people to even budge the things - they were still full of something.

I decided I had to call Jimmy.

Jimmy and I met in the third grade (or thereabouts), and were best friends for most of our growing up. His family lived just down the street, and his father ran an auto-body shop in town. On more than one occasion Jimmy's dad and my own traded parts or services, and our families were pretty close. But while I went to work for my father after graduating high school, Jimmy went to college to study mechanical engineering. He had a natural talent for figuring out things in the physical world, though he was never much good at putting them into practice.

They were **obviously rockets** of some sort. And judging from their weight – it took two people to budge them – they were **still full of something**.

The campus where Jimmy took classes was almost 150 miles away, so he spent his weekdays in a rented room and only came home on the weekends. Since I found the JATOs on a Wednesday, I had three days before I could show them to Jimmy. More than enough time for me to cook up the idea of the rocket car. As a matter of fact, as soon as I realized what that dull metal cylinder represented, I thought about attaching it to a car and taking a jet-propelled ride. The principle seemed simple enough. Nail the rocket onto one of the junkers in my dad's field, point it down a straight stretch of road, and light the mother up.

When Jimmy came over to the house on Saturday morning, we drove to the yard and I showed him the rocket. He immediately knew what it was, or at least what it seemed to be: a solid-fuel rocket, the kind they'd used in Vietnam to give cargo planes a kick in the ass when they needed to take off from short runways. Very simple, very straightforward. Also very dangerous. I described the idea of the rocket car to Jimmy, and at first he was pretty enthusiastic. But after thinking the thing over for a while, he made me promise I wouldn't actually *do* anything with the JATO until he had time to check a few things out.

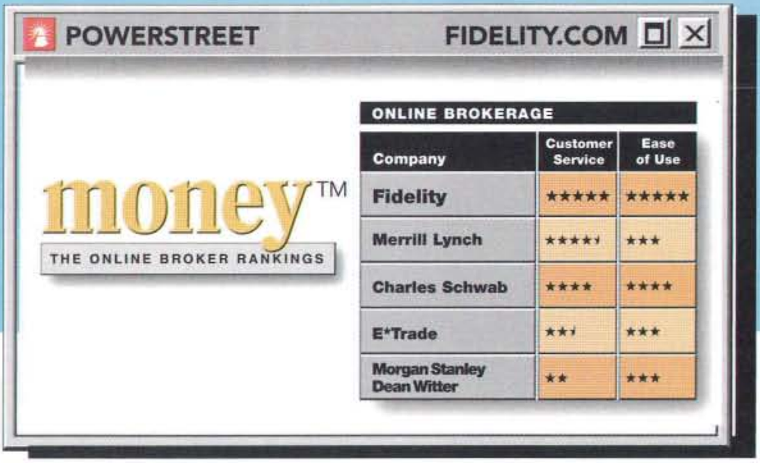
The following weekend, we sat down at his kitchen table and Jimmy explained precisely why the car wouldn't work.

The main problem was control. The JATO bottle would produce something like 2,500 pounds of thrust (albeit for a very short time), which sounded like more than enough to ensure a fun ride. Unfortunately, this huge amount of thrust would not only be unstoppable once it was started, it would probably have to be applied to a point on the car that wasn't designed to handle such force. Under normal circumstances, a car gets its forward thrust from the back axle, by way of tires against pavement, which means that a normal car will never exceed a certain amount of thrust.

Jimmy described the whole thing using top-fuel dragsters as an example: When the driver hits the gas, the back end of the car tries to lift into the air due to the sudden force applied to the rear axle. But as soon as the ass end starts to lift, the tires lose traction, and the thrust decreases. The back end drops, thrust is restored, and the process starts all over again. The fact that a car uses driven wheels creates a self-damping system that ensures the wheels will stay on the ground. The limiting factors are the weight, the distribution of the weight, the size of the tires, and the torque applied to the wheels. The only reason dragsters and funny cars pop wheelies is that they use oversized tires that screw up the relationship between torque and traction. A rocket car would have no such fine adjustments. A massive amount of thrust would suddenly be applied

ILLUSTRATION: MATT MADDEN

WE PUT THE CUSTOMER FIRST, AND ENDED UP THERE AS WELL.



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to a point on a car that wasn't designed to handle it, and there's no telling what would happen next. Maybe the front end would lift off the ground. Maybe the rear. Maybe the ass end would slew around sideways. The only thing certain was that the car would *not* go in a straight line, and would continue to not go in a straight line at a *very* high rate of speed.

Naturally I asked how Craig Breedlove managed to drive the *Spirit of America* at 600-plus miles an hour, but I knew the answer before I even spit the question out. He hired a team of aerospace engineers and rocket scientists to design a car that was *built* to have a jet engine sticking out its ass.

Jimmy didn't even have to outline the rest of the reasons why my idea wouldn't work, but he did anyway. There was the fact that store-bought tires couldn't handle the sort of acceleration a rocket would provide, which was why all land-speed record cars used custom-made solid-rubber tires. Simply *spinning* a regular tire at rocket-car speeds would probably create enough centrifugal force to tear it right off the rim. There was the problem of stopping the thing once it got rolling. There was structural stress. And so on and so on.

I'd pretty much decided that the whole idea was stupid and suicidal, which was why I was amazed when Jimmy proceeded to tell me exactly how the rocket car *could* work.

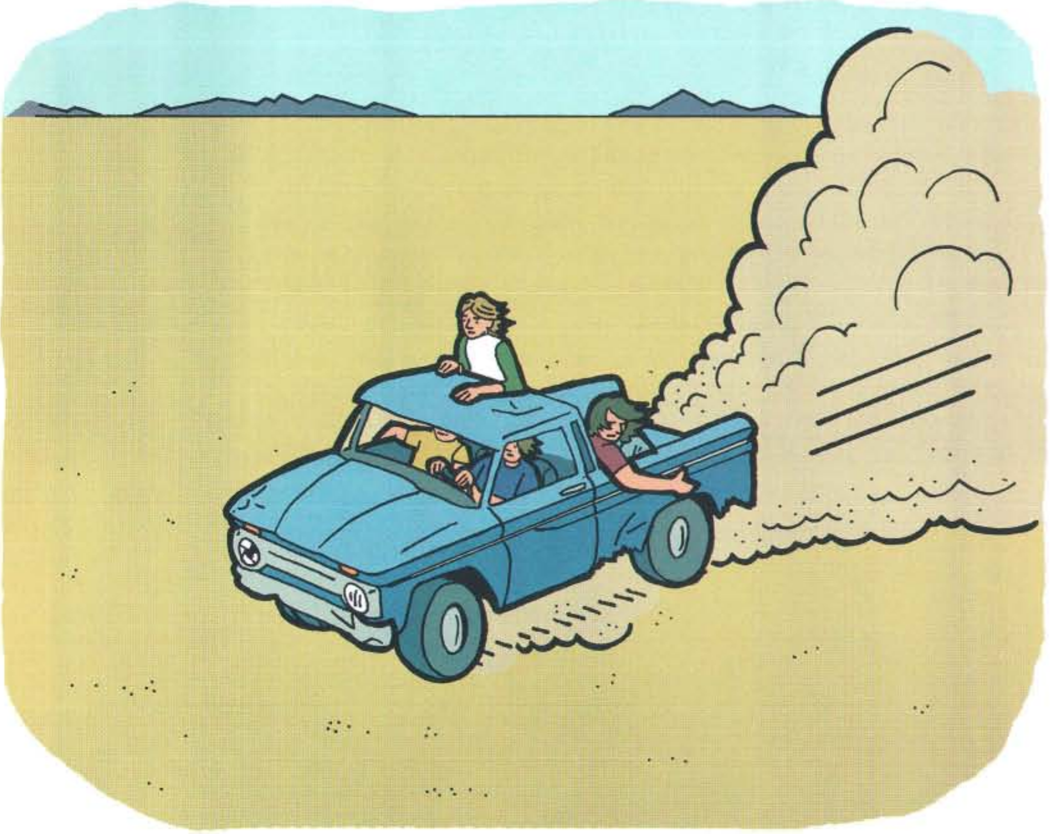
If you were **test-driving** a rocket-powered car, would you choose a section of highway 2.4 miles from a turn in the road **bordered by a cliff**?

Train of Thought

One thing that remains fairly constant in retellings of the rocket car legend is that it took place somewhere in the southwest United States. I've heard versions stating that the whole thing happened in Arizona, Nevada, New Mexico, western Texas, and southwestern California, and in each case, the location seemed to be a critical part of the plot: The rocket car would have to be launched on a long, flat stretch of road, away from prying eyes. What strikes me as incredibly silly about the Darwin Award version of the story is that the pilot chose to test his vehicle on a road with a *curve* in it. If you were going to test-drive a rocket-powered car, would you choose a section of highway 2.4 miles from a turn in the road bordered by a cliff?

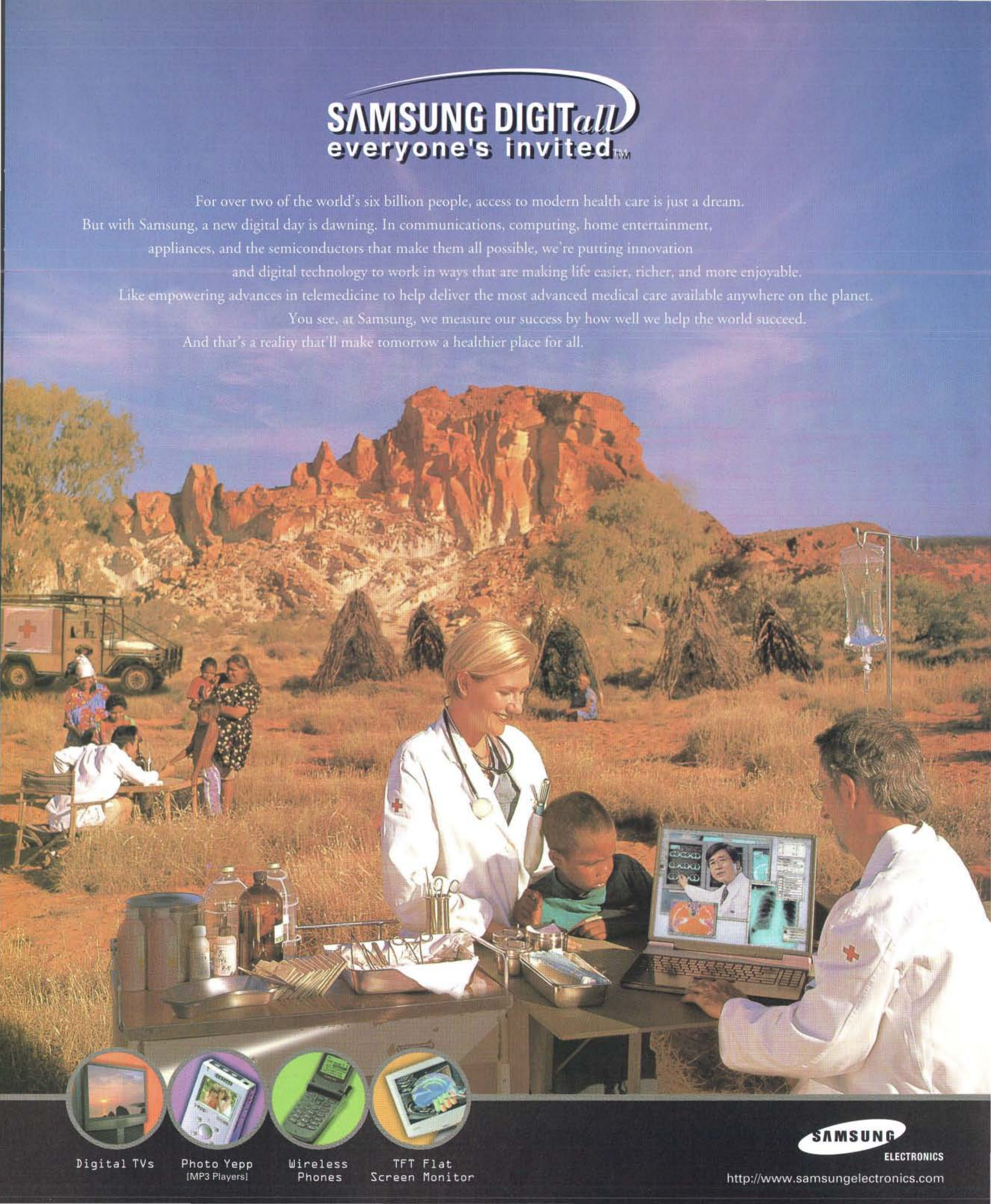
After Jimmy was through demolishing my plans to build the rocket car, he pointed out that the control problem could easily be overcome if the car was actually a rocket *sled*, run on rails rather than asphalt. You see, fortunately, highways aren't the only long, straight thoroughfares through the desert. Mounting the rocket on a railroad car would not only solve the problems of control and traction, but if we used an *abandoned* stretch of track, we'd also no longer have to worry about traffic. And our area of the desert is covered with abandoned railroad track, most of it the old-fashioned narrow-gauge kind used for mining trains near the turn of the century. I knew of at least three such pieces of track within 5 miles of town. Finding a railroad car that would actually run on the old-fashioned track was another story, but by the time Jimmy finished explaining his idea, I already had a plan for solving that part of the equation.

The following morning I found myself bouncing across the desert in a battered four-wheel-drive pickup with the two hitherto unnamed members of Team Rocket Car, Sal and Beck. As kids, Beck and I were almost as close as Jimmy and I, but Beck had a wild streak in him. During high school it got out of control. Beck turned into "one of those dope-smoking degenerates" (Mom's preferred term), and he dropped out a year shy of graduation. Sal was Beck's younger brother, junior not only by calendar count but by any sort of IQ measurement. He wasn't retarded or anything, but people tended to use phrases like "not too swift" and "a few bricks short of a load" more often than usual when he was around.



"The truck was very good for cruising the desert, which is why we used it that morning to visit an abandoned silver mine a few miles from town."

ILLUSTRATION: MATT MADDEN



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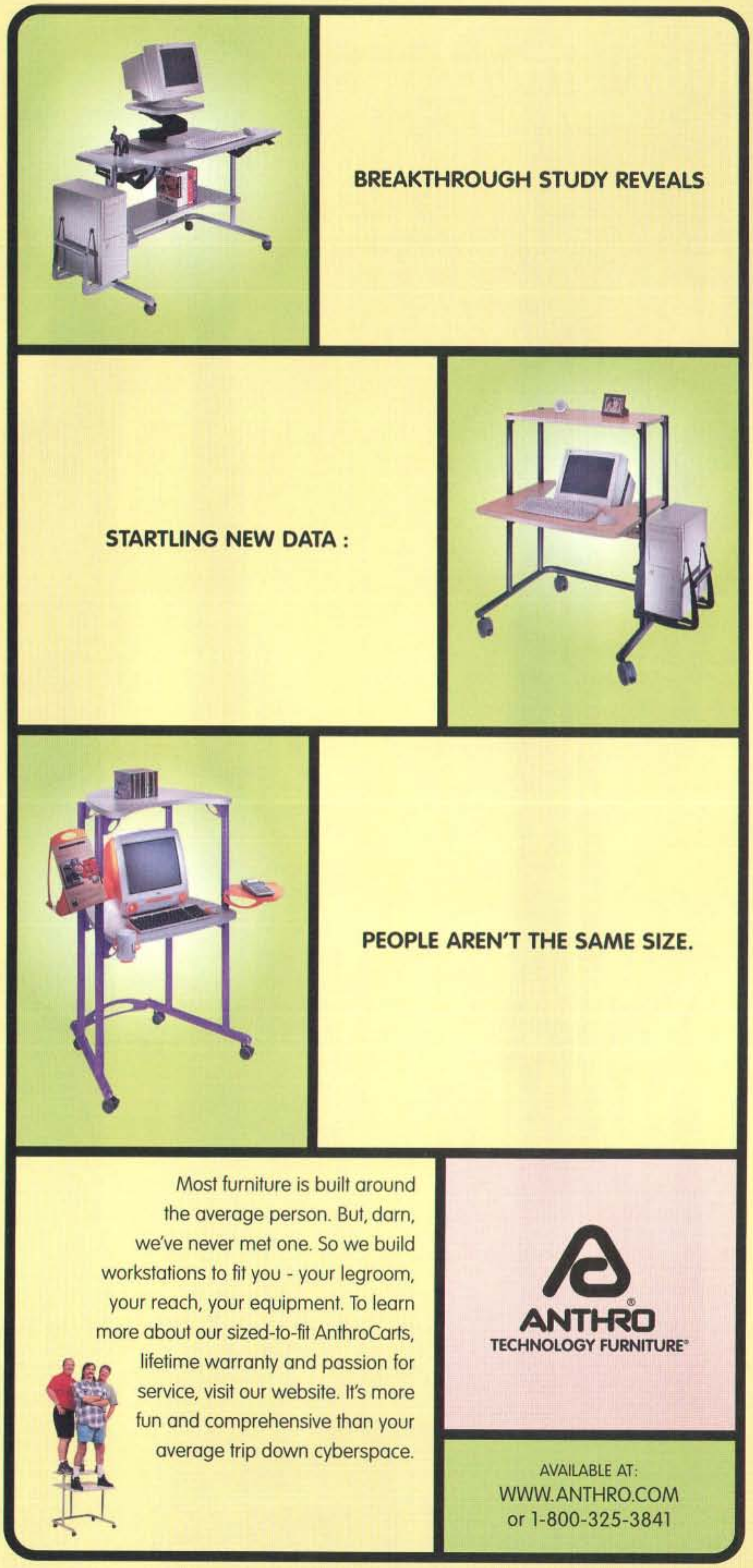

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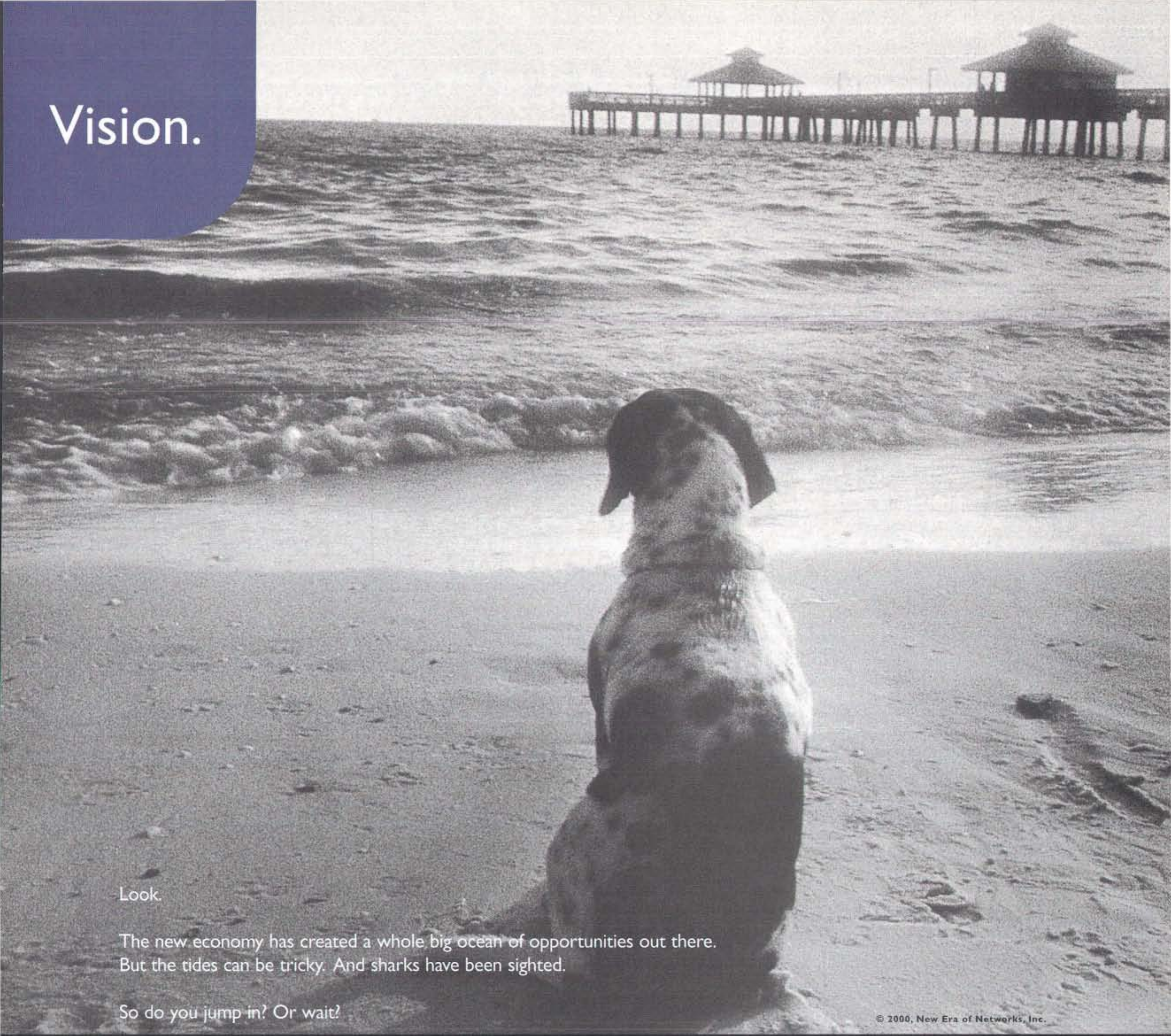
So they weren't exactly Nobel laureates, but I didn't have much choice in my selection of assistants. I needed their truck.

The truck actually belonged to Beck's father, who used it in the performance of his job. Whatever *that* was. Nobody knew for sure what Beck's dad did for a living, but the truck was ugly and battered, sat on huge mud-grabber tires, and came with a massive 454 engine. Beck's father would drive the thing out of town occasionally, sometimes staying gone for days at a time. When he returned, the truck always looked as if it had spent the entire time driving around in the desert. If Beck knew what his father did for a living, he never said. But Jimmy and I figured the man used his pickup for transporting something back and forth from remote desert locations. Contraband vegetation arriving at an isolated airstrip was one possibility, and people desperate to become American residents without a lot of government interference was another. The only relevant fact is that the truck was very good for cruising the desert, which is why we used it that morning to visit an abandoned silver mine a few miles from town.

Beck knew what to expect when we pried off the old wooden planks covering the mine's entrance. Less than a dozen feet into the shaft was a train of three ancient bucket cars, the tiny railcars once used to haul ore out of the mine. They'd probably been parked for 40 years or more, but they seemed to be in reasonably good condition. Shit lasts forever in the desert. Beck dragged a towchain into the mine, looped it around the hitch on the closest car, then used the pickup to drag the whole train closer to the entrance. I used a 5-pound pony sledge to bash the connection between the last two cars until it came free, and Beck threw the pickup into gear and dragged the first two cars clear of the mine. The metal wheels screeched so loud I thought the noise would bring the shaft down on my head.

The first thing we did when we got the bucket cars into the light of day was turn them upside down and slop grease onto the axles. After a few well-placed whacks with the sledge, we got the wheels to turn. A few more whacks, and we had them turning freely enough to push the bucket cars up a ramp and into the back of the pickup.



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Luxury at the Speed of Sound

An aspect of the rocket car legend that always tickles me is that no matter how much the story varies, the make, model, and year of the car is *always* specified. Sure, this is a nice detail to have on hand, but considering the details left *out* of the description, it looks sorta silly. In the Darwin Award version, there's no mention of which highway the car was on, or even whereabouts in Arizona the story took place. But the story *does* specify that the car was a 1967 Chevy Impala. I think the reason this detail is always supplied is because it's critical to make the listener think the test pilot at least looked cool when he flew into the cliff. You'll rarely hear someone tell a story about a guy in a rocket-powered Volkswagen Bug. It has to be a car that *deserves* to have a rocket attached to it.

Our car wasn't a 1967 but a 1959 Chevy Impala: bone-white with a red interior. Once a story starts to mutate into a legend, there's no telling which parts of the truth will stick. Obviously the Chevy Impala part made the cut.

But we didn't choose the '59 Impala for its coolness, or for its aerodynamics or structural qualities, but because it was available. My father happened to have one, resting on cinder blocks, in a forgotten corner of his lot. Engine, transmission, and wheels were all missing, sold to Jimmy's father at some point. The only reason this car was otherwise intact was that Chevrolet used the 1959 style for a single year, which meant the body parts would be usable only on another 1959 Impala.

After I'd cut the bodies away from the bucket cars, attaching the cut away railcar bases to the Chevy's suspension was pretty easy. Jimmy stressed the importance of getting the two sets of wheels precisely aligned, but it wasn't that hard. The old Chevy had plenty of places for bolts and welds, so picking spots where the wheels would line up was a snap. And since the Impala was already up on blocks, it was no problem to slide the wheel frames underneath and lift them into place with a floor jack. I'm sure that these days my students would laugh like hell at the thought of me laying underneath a car with an oxyacetylene torch in my hand, but the fact is, I learned how to draw a bead and cut metal when I was 14 or 15 years old. Growing up around a scrapyard did have certain advantages.

The "propulsion unit" (ha!) consisted of a 5-foot length of steel water pipe welded to the Chevy's suspension. I plugged the end of the pipe facing the front of the car with a slug of scrap steel and welded it into place, and even cut the center out of a threaded cap to screw onto the exhaust end to hold the JATO bottle securely once it was installed. The end-cap seemed like a good idea while I was doing it, though Jimmy laughed when he came the following weekend and saw my handiwork. He pointed at the steel cap. "That rocket is gonna be pushing against the car hard enough to make it fly like a bullet, and you're afraid it'll fall out the *back* end?"

Tough Brakes

The night Jimmy inspected my work on the Chevy, all four members of Team Rocket Car gathered at a neighborhood bar to discuss the challenge of ... the braking system. Of course the lack of any way to stop the car was considered a very minor point with Beck. In his eyes, worrying about something as trivial as brakes was a sign of cowardice. He was perfectly willing to haul the car out to a long stretch of empty track, get in, fire it up, and hope he slowed down before he ran out of track.

He was out of his fucking mind.

The most popular idea among the rest of us was, naturally, a drogue chute. The *Spirit of America* used one, as did a few types of fighter planes, top fuel dragsters, et cetera. But like the optimal solutions to most of our problems, the question was where to *find* one. My father actually had six army surplus parachutes sitting in a storage shed near the office at the scrapyard, the spoils of a particularly good auction years before. Five of them were standard personnel chutes, and one was a massive cargo-drop canopy. But Dad also *knew* he had six of them. He'd started out with a dozen, and occasionally sold one to a sky diver or army/navy store. A good surplus parachute was worth upwards of $200. There was no telling what the cargo chute would be worth to the right buyer. If one were to turn up missing, Dad would certainly notice. Of course we might have gotten away with using a parachute, then returning it once we were finished with it, but even this presented problems. It might work OK for the *first* ride, but how about the second? I certainly knew nothing about parachute rigging. All I was sure of was that there was a *lot* of cloth that had to be stuffed into a very small pack.

When it was time to **stop the car**, the pilot would release air from the shock absorbers. The car would **drop** until it was resting on the rubber runners.

Sal suggested outfitting the car with a huge anchor, one that could be heaved out the window at the critical moment. The rest of us suggested that Sal shut the fuck up and get us another round of beers.

I brought up the idea of stretching a cable across the track and fitting the rocket car with a tailhook to slow it down. After all, aircraft carriers had been using this system to stop incoming planes for years, and it seemed to work just fine. But before I could explain the idea, Beck started laughing his ass off, then asked if I wanted to use a rubber innertube to catch the car, or just tie a rope between two fenceposts. Here was a guy willing to strap a military rocket onto his back and sit in a rusty railcar while someone else lit the fuse, but he was laughing at *my* ideas. Unfortunately, he did have a point. Putting a tailhook on the car and catching an arresting wire was simple. But it sure as hell couldn't be a stationary wire. There would have to be some system to absorb the impact of a car moving at high speeds, and we couldn't come up with anything.

Jimmy pointed out that rocket sleds usually ended up in a pool of water, which both acted as a brake and cooled the whole contraption down. Beck pointed out that in the middle of the desert, pools of water are pretty tough to come by.

Overall, we were batting exactly zero.

I remember being pretty damned depressed when Jimmy and I left the bar

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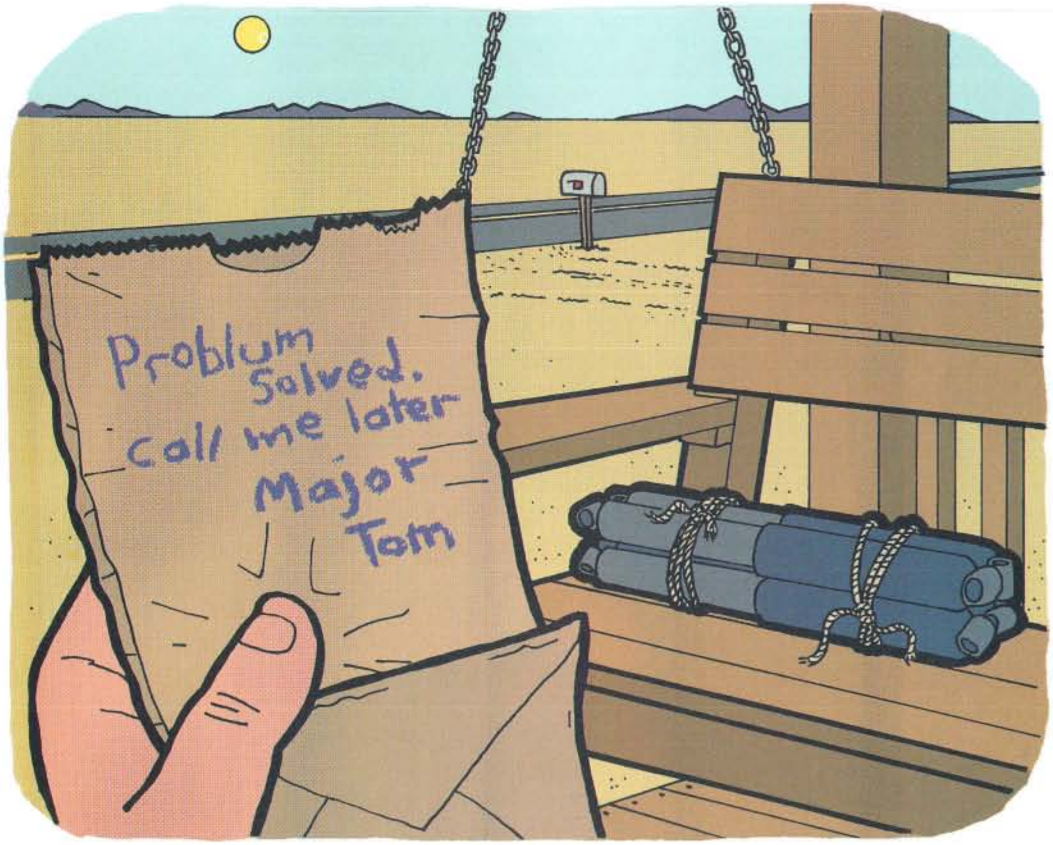

"Out on the front porch, tied together with twine and lying on the porch swing, was a bundle of four thick metal rods."

that night, despite the fact that I was drunk. Jimmy tried to blow some optimistic sunshine up my ass while we walked up the street toward our houses, saying that one of us might be able to come up with something later, once we were all sober. I didn't consider it likely. Beck and Sal seemed to think better when they were drunk. If they hadn't come up with anything at the bar, chances are they never would. And Jimmy and I hadn't nailed the problem that day drunk *or* sober.

Anyway, there's no telling exactly how Sal and Beck spent the rest of their evening, but the next morning my dad woke me up by pounding on my bedroom door. When I finally peeled my eyes open, he asked me who was delivering me car parts in the middle of the night. Out on the front porch, tied together with twine and lying on the porch swing, was a bundle of four thick metal rods. When I looked closer, I saw it was a set of heavy-duty air-adjustable shock absorbers. Jammed under the twine was a note written in what looked like crayon on a crumpled paper bag.

It said this:

Problum solved.
Call me later
Major Tom

Heat of the Momentum

Obviously Beck's creative juices hadn't really started flowing until Jimmy and I left the previous night, and he'd eventually come up with a solution to the braking "problum." He must have spent the rest of the night staggering around town with his brother, a bumper jack, and a crescent wrench, looking for a donor to contribute some hardware to our cause. I never actually *asked* Beck where the shocks came from, and he never volunteered the information.

Beck must have spent **the rest of the night** staggering around town, looking for a donor to **contribute some hardware** to our cause.

His idea was simple, elegant, and easy to put into practice. I'd install the air shocks on the rocket car normally, just as if the car would be riding on pavement instead of rails. But I'd also bolt a pair of wooden beams onto the belly of the car, runners between the front and rear train wheels. Each runner would be thick enough to reach almost all the way down to the tracks, and the bottom would be covered with rubber cut from old tires. The effect would be that the car would roll freely while the air shocks were inflated, with the twin runners suspended inches above the steel tracks. When it was time to stop the car, the pilot would activate a release valve that would dump the air from all four shock absorbers simultaneously. The car would drop until its entire weight was resting on the runners, which would be pressing into the railroad tracks. The runners would function like two brake shoes 3 feet long, pushed against the track under the weight of the car's body, providing a huge amount of stopping power. And since the wheel flanges would also still be firmly on the tracks, the car would remain traveling in a straight line.

When Beck finished explaining his idea, I stood there with my mouth hanging open. We'd talked about dozens of ways to stop the rocket car the previous evening, but nothing even came close to Beck's plan. By the end of the day, I had the shocks installed on the car and a pair of 3-foot-long runners made from sections of 2 x 4 bolted together to make them thick enough to reach the rails. All that was left to do was bolt the runners to the car frame and arrange the air hoses for the shock absorbers, and the car would be ready to test.

When Jimmy saw what I'd done to the car so far, he was impressed. I think he was also a little pissed off that Beck had come up with the idea, and not him. But here's a thought that never occurred to me back in 1978, and to be honest, I'm glad it didn't:

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has agreed to acquire
Hong Kong Telecom
Pending

$20,000,000,000
VERITAS
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Seagate Technologies, Inc.
Pending

$9,300,000,000
aspect DEVELOPMENT
has agreed to merge with
i2 Technology
Pending

$7,932,600,000
whittman-hart
has merged with
USWeb Corporation
February 2000

$4,300,000,000
SIARA SYSTEMS
has merged with
Redback Networks
March 2000

$4,283,000,000
SILKNET
has agreed to merge with
Kana Communications
April 2000

$3,250,000,000
NORTEL NETWORKS
has acquired
Qtera
January 2000

$3,250,000,000
Xros
has agreed to be acquired by
Nortel Networks
Pending

$3,200,000,000
E.PIPHANY
has agreed to acquire
Octane Software
Pending

$2,430,000,000
EarthLink
has merged with
MindSpring
February 2000

$2,100,000,000
NORTEL NETWORKS
has acquired
Clarify, Inc.
March 2000

$2,000,000,000
COMMERCE ONE
has entered into a strategic alliance with
General Motors
Pending

$1,700,000,000
C-CUBE
has merged DiviCom with
Harmonic, Inc.
May 2000

$1,400,000,000
NETIQ
has merged with
Mission Critical Software
May 2000

$1,100,000,000
VA LINUX SYSTEMS
has agreed to acquire
Andover.net
Pending

$990,000,000
CONEXANT
has acquired
Maker Communications
March 2000

$905,000,000
Efficient Networks, Inc.
has agreed to acquire
NetScreen Technologies, Inc.
Pending

$890,000,000
PMC
has acquired
AANetcom
March 2000

$850,000,000
phone.com
has acquired
OneBox.com
April 2000

$674,000,000
CYGNUS
has been acquired by
Red Hat, Inc.
January 2000

$561,000,000
Liberate
has agreed to acquire
MoreCom, Inc.
Pending

$490,000,000
phone.com
has acquired
Paragon Software
March 2000

$471,000,000
WindRiver SYSTEMS
has acquired
Integrated Systems
February 2000

$470,000,000
enCommerce
has agreed to merge with
Entrust Technologies
Pending

$444,000,000
DBT ONLINE, Inc.
has agreed to acquire
Choice Point
Pending

$415,000,000
PMC
has acquired
Extreme Packet Devices
April 2000

$409,000,000
E.PIPHANY
has acquired
RightPoint
January 2000

$333,000,000
Netcentives
has acquired
Post Communications
April 2000

$213,750,000
PHILSAR SEMICONDUCTOR
has agreed to be acquired by
Conexant
Pending

$175,800,000
TUMBLEWEED COMMUNICATIONS
has acquired
WorldTalk
February 2000

€150,000,000
BOSCH
has sold Bosch Telecom Public Network Product Group to
Marconi
January 2000

$116,000,000
Anteon corporation
has agreed to acquire
Analysis & Technology, Inc.
Pending

$100,000,000
FAIRCHILD SEMICONDUCTOR
has agreed to merge with
QT Optoelectronics
Pending

$100,000,000
Marconi
has acquired the SDH/WDM Transport Business of
Nokia
January 2000

$24,800,000
Netcentives
has acquired
Universal Value Network
March 2000

Undisclosed
BOSCH
has sold Bosch Private Networks Division to
Kohlberg, Kravis & Roberts
January 2000

Undisclosed
DeltaKabel
has been acquired by
Lucent
April 2000

Undisclosed
SCHUMANN
has been acquired by
Systor
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We never really had any proof that it was *Beck* who came up with the idea. For all we know, it was *Sal* who dreamed up the notion of using runners to stop the car. Yes, yes, I know, it's a ridiculous thought. Like having your pet hamster wake up one morning with a revolutionary process for splitting atoms. After all, we're talking about the guy who wanted the pilot of the rocket car to hoist a goddamned *anchor* out the window to slow down. Still, you never know.

Anyway, Jimmy gave the braking system his stamp of approval, and I never had to admit to the team that Dad had a bunch of parachutes stashed in the shed. The only reservation Jimmy had about the system was one that should've been obvious to me from the start: heat. If the car were traveling as fast as we expected it to, rubber-coated planks pressing against metal rails would probably get hotter than hell. On the other hand, this *was* basically the same system used by every car on the road. Drum and disc brakes are essentially nothing more than pads or shoes pressing against moving pieces of steel to stop the car. The only difference between their system and ours was that standard brakes pressed brake pads against steel that was spinning, while ours used steel moving in a straight line. And even though our car would be traveling a lot faster than most, we had much more overall braking surface.

As far as the brakes themselves were concerned, all that was left was construction. Bolting the runners to the car frame was quick work, and even though it took a little doing to get the air-dump valve connected to all four shock absorbers, I had plenty of materials lying around the scrapyard to work with. After removing the valve stems from the air inlets to the shocks, I attached sections of air-compressor hose to the valves themselves. The other ends of the hoses ran to an air valve that started life as the door-opening lever on a city bus. With the lever in the "open" position, all four shocks could be inflated from a single air inlet near the dump lever. Once the shocks were pressurized, releasing the lever kept them inflated until the lever was pushed again.

I first tested the air-valve system on Tuesday afternoon, and when I saw that it worked the way it was supposed to, I immediately called Beck. He came to the yard with Sal, and the three of us took turns raising and lowering the car for almost an hour before the novelty wore off. Of course Beck was now more anxious than ever to "take the car for a spin," and he actually got a little pissed off when I pointed out that we weren't out of the woods yet.

See, aside from the heat problem - which didn't cut much ice with Beck - we still hadn't considered how we were going to ignite the JATO. There was a rubber plug in the end of the exhaust nozzle of the rocket I'd inspected, and it seemed logical to assume that some sort of igniter plugged into the hole. Probably an electrical fuse, something along the lines of the igniters used for model rockets. Whatever fueled the rocket (ammonium perchlorate, I later found out) was no doubt highly flammable, and shouldn't be too tough to ignite. But I knew I could come up with something better than a fuse.

A much bigger problem was the launch site. Beck got sulky and petulant when I pointed out that we had no idea where we'd actually run the car. So I put him in charge of finding a suitable spot. His dad's four-wheel-drive was the perfect vehicle for location-scouting, and he and Sal were more familiar with the surrounding desert than anyone I knew.

As Beck and Sal headed for the gates deep in conversation, I got back to work.

The brake-cooling system I ended up building was pretty cheesy, I'll be the first to admit that. But since we weren't even sure it was necessary, I didn't want to spend a lot of time messing with it. I ran a length of garden hose along each wooden runner, near the point where the runner was attached to the car. Took the ends near the front of each runner and led them into the empty engine compartment. I tied off the ends under the car, then punched holes along the sections near the runners with an awl. Water entering the ends in the engine compartment would leak out through the perforations, soaking the runners and pads.

I told you it was pretty cheesy.

The only part of the cooling arrangement that even came *close* to sophistication was the result of a brainstorm that came to me while I was strapping a 5-gallon jerry can under the rocket car's hood. I started putting the sprinkler system together with the idea that we'd simply open a valve before launch, letting water leak out of the hoses and onto the runners for the duration of the run. But while I was attaching the jerry can, a better method occurred to me. Instead of attaching the garden hoses to a valve, I drilled a pair of holes directly into the top of the jerry can, and fed the hoses through the holes. Then I drilled a third, smaller hole, and connected another hose from the jerry can to the air-dump handle for the shock absorbers. I sealed all the hose connections with massive amounts of rubber cement, then called it quits for the day.

No word from Beck or Sal that night, so I assumed finding a launch site wasn't as easy as they'd thought it would be.

When I checked the rocket car the next day, the rubber cement sealant had dried to the consistency of a hockey puck. I filled the air shocks from Dad's portable compressor, then closed the dump valve. Filled the jerry can with water, and screwed the top down tight. Said a quick prayer, and hit the dump-valve lever. There was a slight hiss as the air rushed out of the shocks through the dump valve. But instead of being vented into the open, the last air hose I'd installed directed the escaping air *into* the jerry can full of water under the hood, forcing water *out* through the sprinkler hoses. I had no idea how much air the shocks and air lines would actually hold, but since it was highly compressed air, I'd hoped that when it expanded, it would be enough to displace the water in the can. When I checked under the car there was an impressive puddle forming and water still jetting out of the holes in the garden hoses. Eventually the spray trickled to a stop,

I poured **gunpowder** into a small square of newspaper folded around a **light bulb filament.** Connected to a battery, it made an impressive flare.

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leaving the jerry can more than half empty.

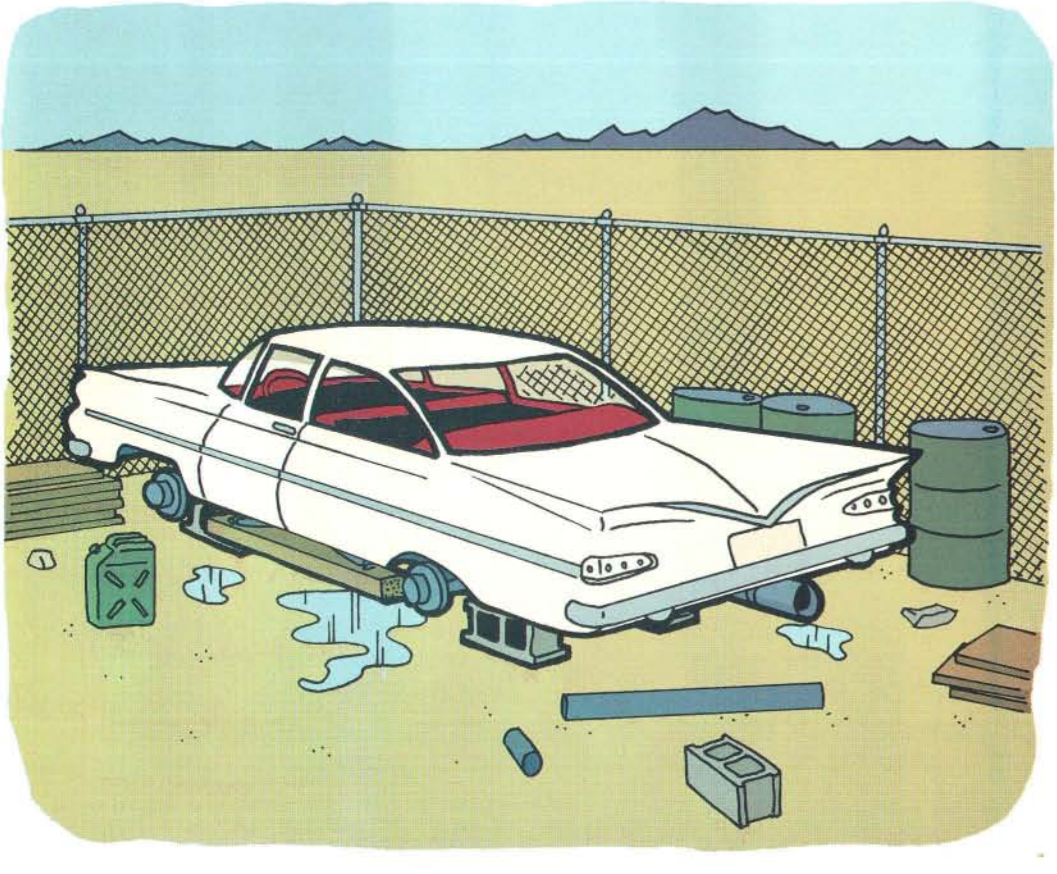
When Jimmy saw the whole system in action a few days later, he said he was "really impressed with my application of Bernoulli's principle." Hell, I didn't even know the Italians *built* rocket cars.

Pangs of Conscience

Before I go on, I think I should take a minute to explain why this whole story is getting so lengthy. Actually, my wife says I should issue a formal apology for inflicting such a long-winded pile of shit on anyone who reads it. And I halfway agree with her. But I want to make you aware of one thing: I did not plan it this way. When I decided to write down the story of the rocket car, I figured it would take all of two pages, maybe three. Four at the outside. That's because I was working from a set of 20-year-old recollections, and a lot of the details were missing. I didn't realize that once I started dredging up these old memories, all *sorts* of bits and pieces would start to fill themselves in, whether I wanted them to or not.

Besides, the technical details of the whole project turned out to be more involved than I initially remembered. When I started writing, I recalled a simple 1-2-3 process that took place over the course of a few weeks. But as I wrote, I realized I had to supply a lot more detail than I'd originally intended to show that we actually *thought* about systems to make the car work and to keep the story from sounding completely stupid. Of course, I'm still not sure I've accomplished the not-sounding-stupid part. Even though the project was executed one step at a time, it had a goofy, ill-planned, Little Rascals feel to it. Because basically it *was* a Little Rascals undertaking. The only thing missing was a sign saying HE-MAN ROCKET KAR KLUB over a treehouse door. If someone had been hurt or killed, or if we'd been caught trying to run a homemade rocket car through the desert, I'm sure we'd all have ended up in the pokey. And even if a judge were willing to overlook the instances of theft and trespassing and illegal possession of military fireworks, we'd have probably been charged with *something*, just on principle. Conspiracy to Commit Flagrant Stupidity, maybe. But nothing like that ever happened.

> Within **5 miles** of town there were a total of three sections of track long enough to run the rocket car on, and they were all **dead losers.**



"The idea of the rocket car sitting on cinder blocks in the scrapyard, just waiting for a place to run it, was driving Beck crazy."

ILLUSTRATION: MATT MADDEN

Having said that, I'd now like to issue a formal apology for inflicting such a shitty, long-winded tale on you.

Location, Location, Location

The idea of the rocket car sitting on cinder blocks in the scrapyard, just waiting for a place to run it, was driving Beck crazy. I have to admit, I was getting anxious to take it for a test run myself. I didn't hear anything from Beck for the rest of the week, and I assumed it was because he hadn't found a suitable launch site. It was actually because his dad had taken the four-wheel-drive out for one of his mysterious desert jaunts, and was gone for the rest of the week. That left Beck and Sal with only one option, driving Sal's beat-to-shit Ford Falcon, a car that barely held its own on pavement, never mind the desert.

Meanwhile, the rocket car waited in the field.

I worked at the scrapyard, as I always had. More than once I thought about what I'd do if my dad suddenly got a buyer for that 1959 Chevy Impala, but there was really no point worrying about such things. If it happened, I was simply screwed.

I did take care of one minor detail during the delay: building igniters for the JATOs. I removed all the taillights and turn-signal lights from the Impala (no matter what became of the rocket car, signaling for a turn wouldn't be an issue) and soldered two wires to each bulb. Next I carefully cracked the glass on each bulb, leaving the filaments intact. The bare filaments would heat to white-hot when connected to a car battery, but simply lying

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a hot filament inside the JATO nozzle didn't seem like it would do the trick. Maybe it would have, but since Beck and Sal still hadn't found a launch site, I had time to come up with something better. So I pulled a dozen of the blank M-60 rounds from the ammo belt my father kept in his office as a decoration, tore off the skinny end of each shell, and dumped out the powder. I poured a little into each of seven squares of newspaper, folded the newspaper squares into packets around the filaments of the light bulbs, and trussed each one up with masking tape. When I connected one of them to a battery to test the idea, it made an impressive little flare.

When Sal and Beck *still* hadn't reported finding a launch site by Friday morning, I even went through the trouble of putting an old car battery on the charger at the shop, installing it in the rocket car, and wiring it to a switch on the dashboard.

Jimmy came back from college again that weekend, just about the same time Beck's father came back from who-knows-where with the four-wheel-drive. During the week I'd had high hopes that we'd be able to launch over the weekend, but when everyone gathered at the scrapyard on Saturday afternoon, I knew it wasn't going to happen.

While Jimmy inspected the rocket car and told us what he'd found out about my JATO bottles (which turned out to be very little), Sal and Beck told us about the launch locations they'd scouted out over the week. And the news was bad.

Within 5 miles of town there were a total of three sections of track long enough to run the rocket car on, and they were all dead losers. Beck and Sal knew the area well enough to realize that most of the modern wide-gauge tracks had been laid either directly on top of, or very close to, the places where narrow-gauge tracks had once existed. So naturally they had started their search at the switching yard near the city limits. There they'd found an excellent set of narrow-gauge tracks roughly paralleling a shiny set of wide-gauge rails. The old-style tracks stretched for miles – but they ran right through a busy switching yard. Not a good place to test a jet-propelled boxcar.

Another possibility was a set of rails that started in the desert, continued for five miles or more, and ended in a soft dirt field that would have been ideal for cushioning any crash that might happen. Unfortunately, this set ran directly through the middle of town, and the field at the end was the Jaycees softball field, right across the street from the police station. Even though Beck must've realized we'd never go for *that* idea, it was obvious he liked it. I imagine he wanted to set the rocket car on the tracks across from the police station in the dead of night, then blow the horn and scream until a dozen cops came running out of the station to see what the ruckus was. At that point he'd hang a moon out the window, then light off the JATO and blaze out of town.

The last location Sal and Beck found was even worse. The Mystery Mine was a bargain-basement tourist attraction a few miles from town that promised to show visitors the "inner workings of an authentic silver mine." People who paid the $2.50 admission were loaded aboard an ancient, rattling mine car and hauled through a few hundred feet of cavern, while a tour guide in a hard hat and goggles pointed at rusted pieces of machinery and chunks of rock. We'd all been on the Mystery Mine tour at one time or another, and everyone agreed that the only thing even vaguely interesting about it was wondering if a cave-in would trap you in the bowels of the mine, forcing you to eat the other tourists to survive. There was an old song that used to play on the radio that described this scenario, and there was a popular joke around town about being trapped in the Mystery Mine and having to eat your way out. A discreet sign near the mine's entrance proclaimed that it was inspected for safety by the US Bureau of Mines on a yearly basis, but everyone knew that ancient mines tended to cave in whether the US Bureau of Mines said it was OK to or not.

Of course, the fact that the Mystery Mine was a tourist attraction presented us with a couple of difficulties. The land around the Mystery Mine did have plenty of narrow-gauge track, but it also had lots of fences, lots of lights, a couple of security guards, and a handful of vicious Dobermans that patrolled the grounds at night.

The prospects of finding a decent place to launch the car were definitely looking grim.

Then at 6 that Sunday evening, I got a call from Jimmy asking me if I wanted to take a ride with him to "discuss a few things." He told me to drive over to his house, and when I got there, he was already in his car. He signaled for me to follow him. When he pulled to the side of the road near the abandoned mine shaft where we'd liberated the two ancient bucket cars, he got out of his car, opened the trunk and took out a tire iron, then headed toward the mine entrance without a word. When I asked what we were doing, he held up one finger in a wait-a-minute gesture. I shut up.

Jimmy stopped in front of the boards we'd renailed over the mine entrance. Even though the sun was almost down, there was still plenty of light to see by. I thought he'd brought the tire iron to pry off the boards near the entrance, but he started walking down the tracks away from the entrance. Ten paces later he'd reached the point where the tracks ended, buried in sand. He took a few more paces, then bent over and jabbed the pointy end of the tire iron into the sand.

To my surprise, it clanked.

Jimmy looked at me with a goofy little smile on his face, and when I realized what he was doing, I smiled myself. He pulled the tire iron out of the sand, walked a few more paces, then stuck it into the ground again. No clank this time. But when he stuck it in again, a few inches to the left, he got the same metallic clank. He was now standing a good 50 feet from the mine entrance, and at least 20 feet from the spot where we all assumed the tracks terminated. He looked up at me, with that dumb smirk still plastered across his face, and said, "So, how far out do you think these tracks actually go?"

Jimmy wasn't suggesting that we **scrap the project outright**, just that we perform a test run before trying it for real. An **unmanned** test run.

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"Jimmy looked up at me, with that dumb smirk still plastered across his face, and said, 'So, how far out do you think these tracks actually go?'"

Safety Second

Why none of us had thought to take a look at the tracks coming out of that abandoned silver mine before this is anyone's guess. Beck and Sal and I had stood right on top of them when we got the bucket cars, but none of us considered the possibility that a long section of the track might still be there, underground. As a matter of fact, "underground" is a pretty drastic term for what we found. The tracks seemed to be covered by a fairly thin layer of drifted sand and dust. The outcrop around the mine shaft broke the wind enough to keep the tracks clear near the entrance, but beyond that, the rails must have been a good place for drifting sand to pile up and eventually cover the rails.

When we got back to the cars that night, I realized Jimmy had asked me to follow him in my own car because he was going back to school directly from the mine entrance. But there was still a matter he wanted to discuss, that matter being the first run of the rocket car. Without a good launch site the matter could wait, but since it seemed as if we'd found one, Jimmy figured we'd better discuss the whole thing immediately. It turned out that he was *very* worried about the first run of the car, particularly the idea of having a person inside when we fired it. Of course I already knew there were plenty of things that could go wrong, since I'd built the thing in a junkyard. But when Jimmy started to lay out the possible ways a person inside the car could get hurt or killed, he made it sound a little less safe than going over Niagara Falls in a barrel.

The last obstacle to running the car was gone. Suddenly the whole thing seemed insane and dangerous and illegal as **hell**.

First, we were dealing with a highly volatile chemical propellant we knew nothing about. We didn't know how old it was, where it came from, or how it was supposed to behave. There was actually a very real possibility that the JATO could explode like a bomb, reducing the car to flame and shrapnel in a split second. But even if it *did* work as expected, the rocket was held in place by a length of water pipe welded to the bottom of a car that was almost 20 years old. If any of the welds didn't hold, there was no telling what might happen. Then there was the matter of the brakes. All we had was a setup that sounded like it might work. But if someone inside the car found themselves going 100-plus miles per hour and the brakes *didn't* work ...

Jimmy wasn't suggesting that we scrap the project outright, however, just that we perform a test run before trying it for real. An *unmanned* test run. Rig a system to activate the brakes at some point after the JATO had burned out, point the rocket car down the tracks, and let it run pilotless the first time. After all, it wasn't as if we needed a man at the tiller while the car was moving. The person we'd been referring to as the "pilot" would actually be the "passenger" anyway, his sole duty being to hit the dump valve before the car ran out of track. And since we had four JATOs, wasting one for the sake of safety seemed like a prudent move.

I had to admit, he made a lot of sense.

I pointed out that Beck would probably have a bird when he found out we weren't going to let him drive the car on its maiden voyage, but we both agreed that it wouldn't be a major problem as long as Beck got to drive it on the first *manned* run. We'd just take a second JATO along, and if the car ran successfully the first time, Beck could take it out the second time. If the car ended up a twisted lump of smoking metal, Beck would be happy we decided to take the precaution.

With these details settled, I said good-bye to Jimmy and headed home. The next day I was busy at the yard sorting through the latest load of junk my dad had bought over the weekend, but I found time to rig the brakes for our test run. All I did was twist a screw eye into each brake runner, then run a length of piano wire through the openings in each eye and up through a hole in the Chevy's floor. I tied the ends of the wire to

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a short stick, and used it to prop the brake's dump valve in the up position. Then I looped a piece of rubber from a bicycle inner tube over the lever, and tied it under the valve box. The bike tube pulled the lever toward the dump position, but the lever couldn't move with the stick propping it up. I figured that once we found a good section of track, all we'd have to do was drive a spike into one of the rail ties at the point where we wanted the brakes to kick in. When the car passed over the spike, the spike would snag the wire, pull out the stick, and the dump valve would snap down, activating the brakes.

Now, if you're getting tired of hearing about all the Rube Goldberg bullshit I was adding to this machine, take a minute to think about how *I* felt while I was doing the work. By the time Jimmy suggested that we rig "some sort of automatic brake system," I was getting mighty sick of rigging and drilling and bolting and cutting. And I was tired of trying to figure out ways to make important things happen by using other people's garbage. I made up my mind that the auto-brake was the last piece of work I was going to do on the car. If what I'd built at that point wasn't good enough, I'd simply turn the whole mess over to Beck and let him drive the fucking thing into the Mystery Mine, or past the police station, or wherever he wanted to blast it.

Meanwhile, I'd at least assign Beck the job of clearing the rails. He accepted enthusiastically. With the help of Sal, he broke back into the abandoned mine, grabbed the last bucket car, and pushed it down the length of the tracks with the bumper of the pickup. Once the wheels loosened up, the bucket car worked like a snowplow and cleared the tracks with a single pass. When I drove out to the abandoned mine after work on Thursday, I found two rusty metal rails poking out of the hardpan, starting at the mine entrance and extending out into the distance. When I banged one with a rock, I heard plenty of good steel under the rust. And best of all, they were 2 miles long and straight as an arrow.

For me, this was the point when the whole project made the transition from theory to reality. I squatted next to those tracks and realized that the last obstacle to run-

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ning the car had been removed. And to my surprise, it didn't feel good at all. Suddenly the whole thing seemed stupid and insane and dangerous and illegal as hell. But it was way too late to stop.

Counting Down

If the track had been ready on Monday, I don't think I could've convinced Beck to let the maiden voyage of the rocket car wait until Jimmy came in on the weekend. As a matter of fact, the only way I was able to get him to wait as long as I did was by agreeing to start getting things ready on Friday.

After my dad and I went home on Friday, I returned to the yard and found Sal and Beck waiting. We backed the flatbed into the weedy field where the rocket car was docked, set up the ramps, and hoisted the car onto the flatbed with the winch. I drove the flatbed out to the abandoned mine and down the slope to the tracks, scared shitless that I'd get the truck stuck in the soft sand. But I made it down the slope OK, and we lowered the rocket car onto the tracks, its nose facing the mineshaft.

It looked perfectly at home sitting on the rails. Like that's where it was meant to be. But we didn't have time to stand around admiring the thing. Even though we were 100 yards from a fairly secluded stretch of highway, the sight of a five-ton flatbed, a four-wheel-drive pickup, and a rocket-powered '59 Chevy on railroad wheels would've looked pretty peculiar to anyone coming down the road. So as soon as the car was on the rails, I climbed into the Chevy's driver's seat and Beck pushed me down the tracks with the pickup's bumper until the car was close to the mine entrance.

A brake failure would mean the car simply **flew into an abandoned mine.** We could declare the experiment a failure and call it a day.

We pulled the boards from the entrance again, and Beck used the pickup to ease the Chevy in. Once it was all the way inside, he took me back to the flatbed and followed me back to the yard. I parked the flatbed where it usually spent the night, we loaded the portable compressor for the shocks into the pickup, and we returned to the mine to run a test of the rocket car's brakes.

Since we didn't have a tow chain with us that night, we had to muscle the car far enough out of the mine for Beck to get the truck in front of it and push it back down the tracks. When we got the car about a mile from the entrance, we let it coast to a stop. Beck jumped into the Chevy with a maniac grin on his face, and Sal maneuvered the pickup behind him. Beck gave us a jaunty thumbs-up, and Sal hit the gas. We picked up speed until we were doing about 50, and just before I was about to scream at Sal to stop, he hit the brakes. We watched the rocket car pull away at a goodly clip.

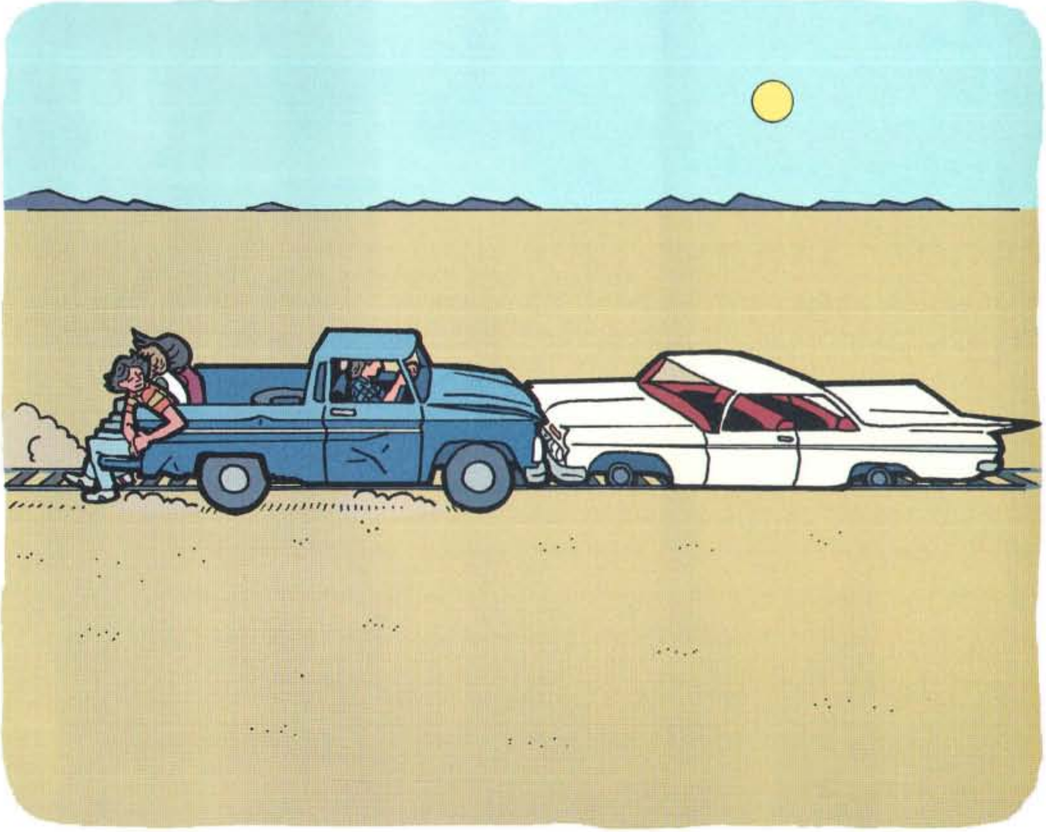
And keep going.

And keep going.

And just as I was wondering if the brake system might have malfunctioned, I saw the ass end of the Chevy pitch up slightly as Beck hit the dump lever. Sal and I both let out the breath we'd been holding. When we got down to where it had stopped, the car was resting on its runners, and Beck was sitting on the hood. Less than 20 feet from the mine entrance.

I thought he might make up an excuse for waiting so long to stop, that the brakes didn't work or whatever, but he didn't even bother. When I asked what the fuck was wrong with him, he just said, "Hey, I didn't feel like pushing this fucker all the way to its garage, so I let it coast most of the way. You have a problem with that?"

The runners had scraped the rust off 10 feet of the rails, and when I looked under the rocket car, water was still squirting out of the hoses.



"Beck got in the truck and drove around to the front of the rocket car, then pushed the car out to the opposite end of the track, with the rest of us riding on the tailgate."

ILLUSTRATION: MATT MADDEN

Leftoff!

The first (and last) test run of the rocket car happened on Holy Saturday, 1978. For the non-Christians in the house, Holy Satur-

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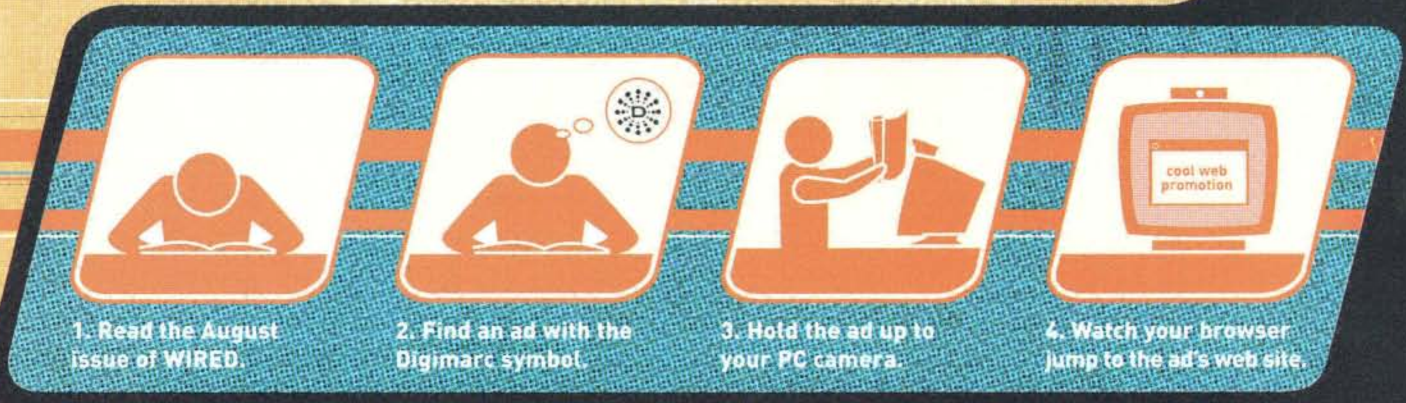

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day is the day before Easter, a day the faithful are supposed to spend preparing for the Easter feast and quietly contemplating the Miracle of the Resurrection. My family has been Catholic for about a thousand generations, so I suppose this put me firmly among the ranks of the faithful. Which means the Pope probably would've frowned on my spending the day before Easter experimenting with illegal military ordnance and trespassing on private property. But I'm also confident that nothing in the Bible *specifically* covers what we were doing that Saturday morning, so I probably had some wiggle room.

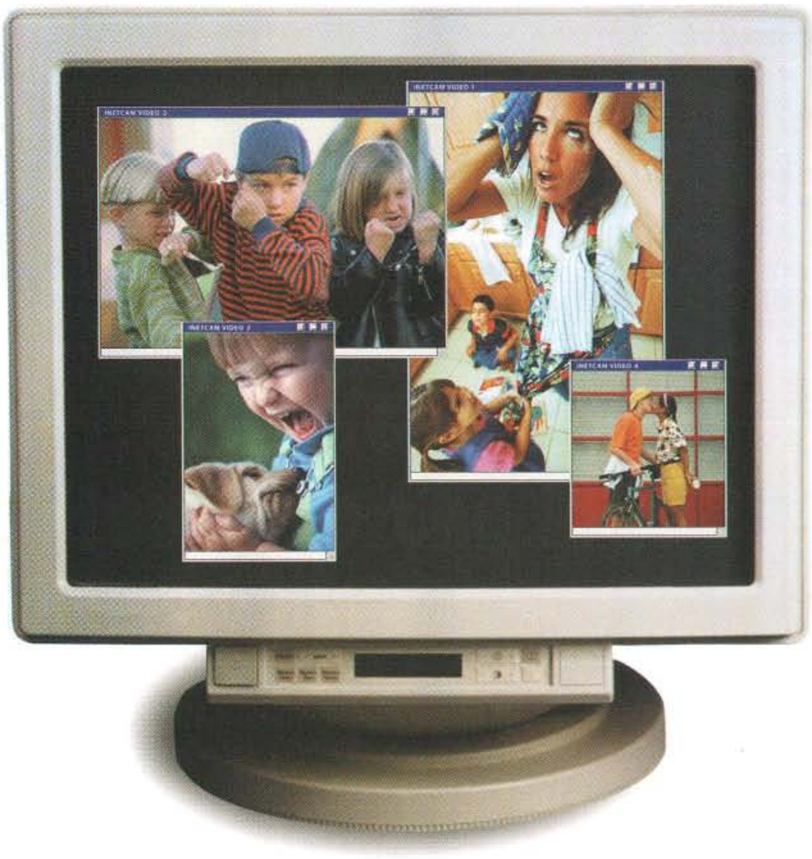
We assembled at the abandoned mine early in the morning, just before dawn. The story for my parents was that Jimmy and I were driving up to … a big city in the area (you'll excuse me if I don't specify which one) and wanted to get an early start. Jimmy was using the same excuse for anyone at his house who was curious. Dad wasn't even going into the yard on Holy Saturday, so I had the day to myself. I went to Jimmy's house and found him waiting for me on the front porch, and we left for the mine.

When we arrived, Sal and Beck were already there, sitting on the hood of the pickup, which was parked near the mine entrance. They even had the boards pulled from the mine entrance and the car pushed out into the open.

Beck got in the truck and drove around to the front of the rocket car, then pushed the car out to the opposite end of the track, with the rest of us riding on the tailgate. It wasn't until the car was stopped at the end of the track that Jimmy asked what turned out to be a very important question.

He said, "So why is it pointing *this* way?"

Sal and Beck and I stared at the car for a minute, and although I can't speak for the other two, I was trying to come up with something to say. To be honest, I'd never given it much thought. I suppose when the car was first brought to my dad's scrapyard, it was towed in front first, because the front end was farther from the path winding through our yard. When we loaded the car to bring it to the mine, winching it onto the flatbed rear first was simply the easiest thing to do. And when we got to the railroad tracks the day before, I'd simply driven the



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flatbed to the end opposite the mine shaft and parked facing away from the entrance. It seemed like a good way to avoid driving the flatbed over the tracks themselves, which might have damaged them. When we had rolled the car down the planks and onto the tracks, it had ended up facing the mine entrance. Sure, we could've set it on the tracks facing the opposite way, but … nobody thought of it.

So the three of us gave Jimmy a shrug, and I asked him what difference it made. He walked around the car looking thoughtful, and after a while said, "None. This is good."

Later on, I figured out what he'd been thinking. If something went wrong with the car (specifically the brakes), which way would we want it to be pointing? If the brakes failed while it was heading *away* from the mine, the car would eventually run onto the wide-gauge rails at the end of our narrow-gauge track. And with the flatbed back in the yard, it wasn't likely we'd be able to get the car off the tracks if it got stuck there. But with the car pointed *toward* the mine, a brake failure would mean the car simply flew into an abandoned silver mine. We could declare the experiment a failure, nail the boards back up, and call it a day. Of course, the equation looked a lot different with a passenger on board, but that's why we were doing a test run first.

Ah yes, the test run.

Once Jimmy was through looking the car over, I broke the news to Beck that the first run would be unmanned. He didn't like the sound of that a bit, even after I explained to him that it was in his best interest. He wanted to ride in the car on the first run, and it took a while to convince him that it wasn't going to happen. When he'd grudgingly accepted our logic, we took one of the JATOs out of its crate and loaded it into the pipe at the rear of the car. Then Sal drove me down the tracks toward the mine. When the odometer had ticked off exactly a mile, I made him stop while I got out and pounded an 8-inch spike into one of the wooden ties, which were still solid enough to hold the spike well. We drove back to the rocket car and found that Jimmy and Beck had already shoved one of my igniters into the JATO nozzle, attached the leads to the roll of field-phone cable with wire nuts, and were unrolling the cable away from the tracks. I told Sal to park about 50 feet away from the Chevy, with the broad side of the truck facing the tracks. I wanted to have the pickup truck between me and the JATO when it was lit.

You know what it looks like when you shoot a paper clip with a rubber band? One second it's between your fingers. The next it's … gone.

I filled the can under the Chevy's hood with water from one of the jerry cans, closed the hood, and rigged the automatic brake. The wire stretched between the runners was only 5 or 6 inches above the railroad ties, low enough to catch on the spike with no problem. Beck came over to watch the whole procedure, a little miffed that the unmanned test had obviously been planned out well in advance. But by then it was too late for him to raise any serious objections. If the car ran OK, he'd get his ride. If not, he'd be grateful we made the test.

Once the brakes were rigged and the water can filled, there was only one thing left to do: Light the mother and see what happened.

We all gathered around the truck, Beck popped the hood, and I cut the field-phone wire from the roll and stripped the ends. By then the sun had climbed over the top of the mountains, and we had a clear view of the entire track. I wrapped one of the wires around the corroded negative post of the truck's battery, and just as I was about to touch the other wire to the positive, Sal yelled, "Wait!"

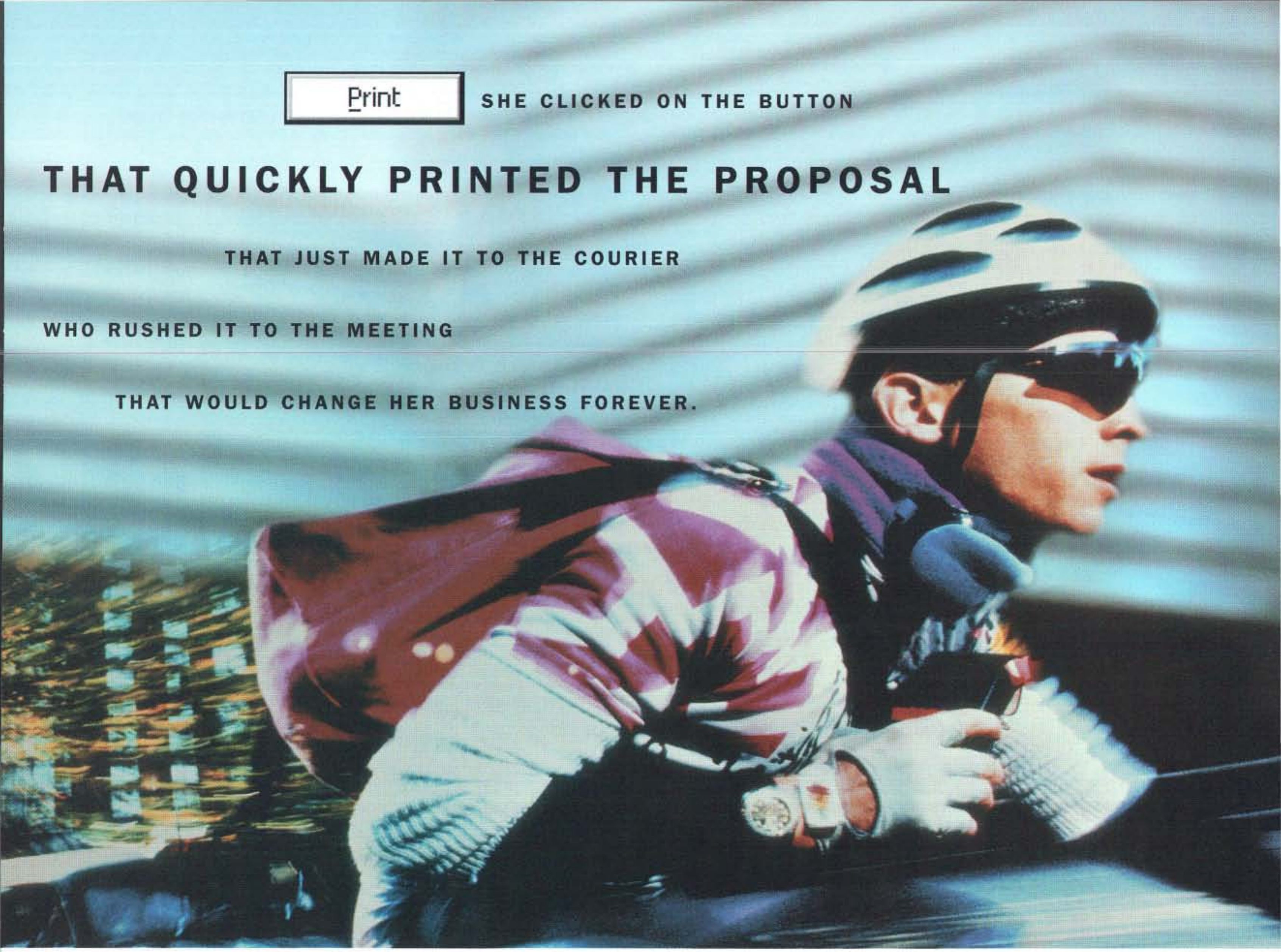
He scared the shit out of me.

I said, "What? What? What's the problem?"

Sal looked slightly embarrassed. "Shouldn't

"We all ran up the slope to get out of the artificial fogbank, but the roar from the rocket stopped as quickly as it started."

ILLUSTRATION: MATT MADDEN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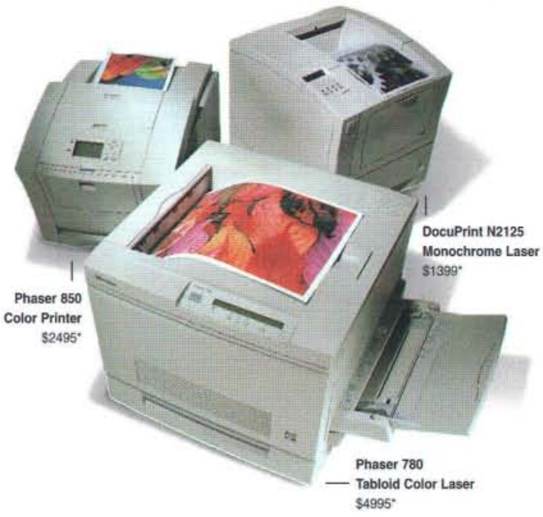

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we have a countdown?"

Jesus Christ.

Beck gave him a smack in the back of the head, but I told him sure, if he wanted a countdown, we'd have a countdown. So Sal counted down from ten, and when he reached zero, I touched the wire to the lead of the battery.

The events that followed happened so damned fast that I'm surprised my mind was able to record everything. But even though parts of this story have grown foggy over the years, the memory of the actual Flight of the Rocket Car remains crystal clear.

When I touched wire to battery post, we heard a little fizz. I knew what it was, since I'd heard it before: the igniter going off. I didn't expect to hear it, since I figured the rocket would light instantly. Instead, it hissed for a second, then stopped. But before I could start to worry if the rocket was a dud, there was a massive eruption of orange flame from the ass of the Chevy. Along with the flame was a huge, howling roar, something nobody had counted on. We'd all seen the Apollo launches on TV, and we *knew* that rockets were noisy, but nothing had prepared us for this. It sounded like … like a solid-fuel rocket igniting.

I've been trying to figure out a way to put it into words, but the sight of the rocket car taking off is almost impossible to describe. You know what it looks like when you shoot a paper clip with a rubber band? One second the clip is between your fingers, and the next it's just … gone. You can't track it with your eyes, because it moves too fast. All you can do is hope to shift your eyes to where it was going, so you can see where it hits.

Think of the same thing happening with a 1,500-pound car.

In the space of a second, the car jumped down the track, away from us, and we were enveloped in thick, chemical-smelling smoke. We all ran up the slope to get out of the artificial fogbank, but the roar from the rocket stopped as quickly as it started. Jimmy'd said the burn time on our JATO was 2.2 seconds. I staggered up the slope and looked down the tracks, to see that the rocket car was moving along at a rapid pace, toward the spike I'd driven in the railroad tie. And although it was moving damned fast, it was far enough away so that I can't even take a guess as to how fast it was going. My eyes were still burning from the rocket smoke, but I did see it pass the point where I'd planted the spike, and then …

Something happened.

Intellectually, I know exactly what happened. The spike caught the piano wire, pulled the stick out from under the dump-valve lever, and the air shocks lowered the car to the rails. I didn't actually see the car drop, but it must have. Because a second later, more smoke started pouring out of the car. Only this time it was coming from *under* the car, and it was steam, not smoke. The runners had heated up, and the water shooting onto the hot brakes was turning into steam.

But the car kept going.

And going.

It didn't seem to be slowing down. It *must* have been, since the runners were obviously pushing against the rails hard enough to create a lot of heat. But the car kept moving, closer and closer to the mine. It never made it to the entrance.

Later on, Jimmy and I had a long discussion about what happened next, but we were too far away to have a clear view. Maybe one of the runners burned away and got caught in the ground. Or on the tracks. Maybe one of the old axles finally reached its breaking point. Or one of my welds couldn't take the strain. Whatever it was, the rocket car derailed about 20 yards from the mine entrance and continued moving toward the mine. Actually it was straddling one of the rails, going 60 or 70 miles an hour, screeching and screaming and kicking up a cloud of sparks.

And it was no longer aligned with the mine entrance, either.

The Chevy slid down the tracks, but instead of driving straight through, it went in at an angle with the ass end canted toward the road. The front end smashed into one of the huge timbers that outlined the mine entrance, cracking it in half. After a very short pause, the timber collapsed, immediately followed by the overhead timber it supported. Those timbers must have been under considerable stress, because a second later the entire entrance to the mine collapsed on top of the rocket car with a huge grinding rumble and a cloud of dust.

I just gawked. I remember that part clearly, standing there looking at the car in the distance, just before dust obscured the picture. My rocket car was sitting there like a busted Tonka truck with a mountain falling on it.

Moments later I became aware of voices shouting behind me. I turned around and saw Jimmy and Sal in the bed of the pickup, and Beck behind the wheel. They'd obviously had the sense to get into the truck and chase down the rocket car, while I stood there with my mouth hanging open. I jumped into the bed, and Beck floored it toward the mine entrance. Toward the *former* mine entrance. During the short ride, I wondered how we were going to haul the car out of the pile of rubble, but when we got closer I saw that it was a foolish idea. The front half of the car was crushed like a beer can, under boulders ranging from the size of a watermelon to the size of the car itself. Smaller pieces were still coming down when we got there. The only way that car was ever coming out was if someone torched off the back end and hauled it out with a winch.

The front half of the car was crushed like a **beer can**, under boulders ranging from the size of a watermelon to the **size of the car itself**.

Beck stopped the truck a safe distance from the wreckage, and we all got out to look. But there wasn't much to look at. The only thing *not* buried by the cave-in was the last 4 feet of the car. The trunk lid and rear bumper and rocket were visible, but the rest of the car was buried under boulders and rubble.

Jimmy quickly summed up our situation. At that particular moment, there wasn't much we could do in the way of damage control. The car was stuck. The JATO was wedged in too tightly to remove, too. And

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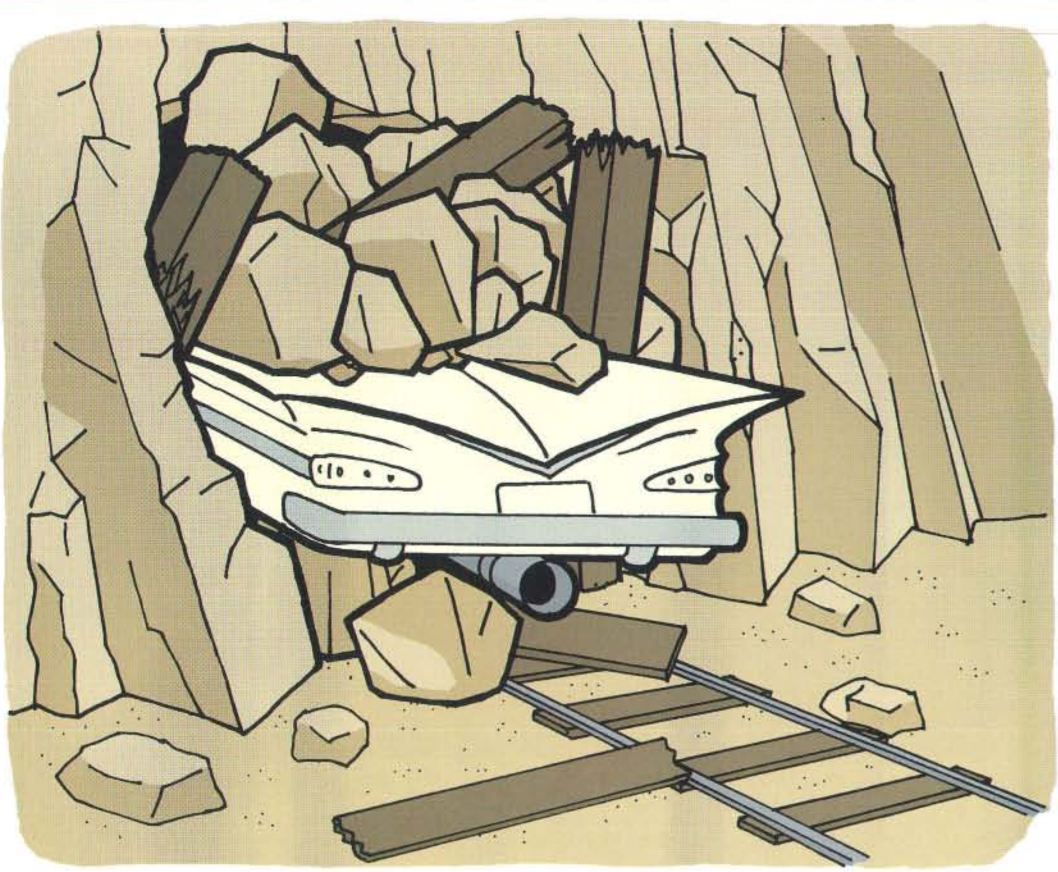

"The trunk lid and rear bumper and rocket were visible, but the rest of the car was buried under boulders and rubble."

if *we* couldn't move it, then it was unlikely anyone else could. Not without a major effort. Fortunately, the only thing to show that we'd even *been* there was the piece of field-phone wire at the other end of the tracks, and the remains of the rocket car itself. Which meant that it was an excellent time to get the hell out of there.

We needed no more encouragement. Beck and Sal ran for the cab of the pickup, Jimmy and I piled into the bed, and Beck pointed the truck toward the road and stomped the gas. I guess he didn't have the four-wheel drive engaged, because the back wheels of the truck threw up rooster tails of sand as we took off up the slope. But we didn't get stuck. We shot up the slope, bounced onto the asphalt, and as soon as the rear wheels hit the asphalt they started burning rubber. Beck only stopped long enough for Jimmy and me to bail out and run to my car.

Then suddenly Jimmy ran back down the slope. I yelled after him. He stooped and grabbed something from the ground. When he reached the car he tossed the wad of field-phone wire in the back seat and jumped in. I punched the gas, spun the car around, and headed back toward town.

Cover-up

So that's the whole story of the rocket car. I never went back to the mine, and neither did Jimmy. We discussed what we'd do about the wreckage while driving back to town, but nothing we came up with seemed to make a lot of sense. If we went back to the site later that day, there was a fair chance we'd be spotted. And now there was a very obvious piece of forbidden military hardware at the site in plain view. The thing that kept repeating over and over in my head as we drove back to town was that paragraph in my dad's auction paperwork. The one about possession of controlled military hardware. It was then I decided the best way to handle the whole thing would be to not handle it at all.

Whoever **discovered** the car sticking out of the butte didn't make a big fuss about it. The papers didn't cover it and **the cops never came** to visit.

And that's exactly what we did.

Actually, timing and nature lent a hand. The following day was Easter Sunday, and there was no way Jimmy or I were going to avoid spending it with our families. And even if we wanted to, it wasn't a good day to be screwing around out in the desert. Late Saturday night a windstorm kicked up, strong enough to make the local TV stations interrupt programming with traveler's advisories in our area. Nothing very odd about that, not in our area in the springtime. But this time I was thrilled to hear the reports. High winds and blowing sand could serve to obscure the signs of what we'd been doing in the desert that morning. If sand was blowing across the streets in the middle of town, it must've really been kicking ass in the desert. Later that morning I saw Jimmy at church, where we exchanged several Significant Looks.

The next day, Jimmy went back to college. I went back to work at the scrapyard, and I have no idea what Beck and Sal did. I spent the next few days trying to act as normal as possible, expecting a police car to show up at the yard any minute. But curiosity finally got the best of me, and I called Beck on Wednesday. We met that night at the same bar where we'd discussed brakes for the rocket car, and Beck told me he *had* been out to the mine, actually a couple of times. Once he even brought a camera and took a few pictures, because what he saw was so damned funny.

Funny?

He explained. The storm that blew through the area on Saturday night had indeed eliminated most of the signs of what we'd been doing. The tire tracks made by his dad's pickup were completely eliminated, and the railroad tracks were almost reburied. But the rocket car was still exactly the same as when we left, ass end hanging out of a pile

ILLUSTRATION: MATT MADDEN

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of rubble with a rocket sticking out of it.

Beck pointed out what the scene must have looked like to a person driving toward the crash site: You're driving down a stretch of road, toward a butte that used to have a mine entrance in the side of it, but now there is no mine shaft - just the rear end of a car sticking out of nowhere.

And then, the twin skid marks on the highway where Beck's truck leaped onto the roadway. Skid marks pointing directly at the rocket car.

Aftermyth

Now, I have to admit one thing. I didn't start hearing rumors right away. Nobody did. I didn't see any articles in the paper, the cops never came to visit. All I can say is that whoever discovered the car sticking out of the butte didn't make a big fuss about it.

And I'm pretty sure someone *did* discover it. I saw Beck once more after our meeting in the bar, at a Memorial Day party a few weeks later. He was pretty drunk at the party, wanted to talk about the whole thing, and I had a bitch of a time getting him to a private spot so I could listen to what he had to say. He said he'd gone out to the crash site a few days earlier, and the rocket car was gone.

I said, "What do you mean, gone?"

But "gone" is just what he meant. He drove past the spot, couldn't see the car from the highway, and went down the slope to take a look. When he got there, he couldn't find any trace of the car ever having been stuck in the mine entrance. All I could think at the time is that the rubble pile must have eventually shifted to cover the car completely. Beck seemed doubtful when I suggested it, but like I said, he was pretty drunk. He said it looked more like the car was pulled out of the hole and taken away. But that's a bunch of bullshit. It has to be. To start with, none of us were there long enough for the scene to form a lasting impression. We looked at the wreckage for maybe 15 minutes before we were back in Beck's truck and hauling ass out of there. Maybe Beck saw enough so that he could tell if the car had been moved, but I wouldn't be able to tell.

Later on I started thinking about what would have happened if the county sheriff had driven by and seen the Chevy sticking out of a rockslide. Or even if someone had called the sheriff and reported it. See, the abandoned mine was far enough from town so that it probably wasn't inside the city limits, which means that it wouldn't be the business of the city cops. And folks who don't live in town learn quickly who they're supposed to call when there's trouble. Oh, I'm sure a state trooper would've stopped to check it out if he'd spotted it while driving past, but the troopers mainly stick to the interstates, occasionally pulling into one of the towns along the way for doughnuts or coffee. No, if some law-enforcement outfit stopped to investigate the crash site, it almost certainly would've been the county sheriff.

So what would *he* have done?

I honestly don't know, but the sheriff's office wouldn't have called the city cops unless they *had* to. My dad always hinted at animosity between the two departments, the city cops considering the sheriff's department a bunch of hick-assed Deputy Dawgs, and the sheriff's department thinking the city cops were a gang of self-important pricks. And neither group liked the state police, who, by all accounts, *are* self-important pricks. So I try to think of what the sheriff would've done if he'd come across the crash site, and it occurs to me that the first thing he'd have seen was what appeared to be a rocket nozzle sticking out of the back end of a car. If I were the sheriff, I'd have immediately called the army base where Dad and I got the JATOs in the first place. Who else would be qualified to deal with such a thing? Evel Knievel?

And if the sheriff *did* call the army, and they had some DOD people come out and take a look, anything could've happened next. The military bomb squad might have taken one look at the expended rocket, told someone at the base to send out a truck with a winch, and they may have yanked the car right out of the rubble and taken it away. After they determined that there was no corpse in the car, it wouldn't be the sheriff's business anymore. Or anyone else's.

Case closed.

But I never did any serious investigation of these possibilities, for two reasons. One, I didn't want to do any snooping that might look suspicious. Two, I didn't hang around town very long after that. Two weeks after the test of the rocket car, I drove to … the biggish city I mentioned earlier and took the ASVAB test. That's the test they give you before you join the military. And a few weeks after talking to Beck for the last time, I shipped out for navy basic training.

> When **I told my dad**, he laughed so hard I thought I'd have to call the paramedics. He'd heard the tale, but he'd **dismissed it** as just another stupid story.

Before you make any assumptions about my joining the navy to escape the repercussions of the rocket car incident, let me tell you that I absolutely did *not*. If the rocket car had anything to do with my joining the navy, it was just to give me a gentle nudge in a direction I was already heading. Hey, take a look at the situation I was in. I was 22 years old, living with my folks, and working for my dad in a junkyard at the edge of a shitty little town in the desert. Not exactly a Future With Promise. I guess college was a possibility, but Dad didn't really make enough to pay my way, and I didn't feel like repaying student loans until I was 100 years old.

Why the navy? Well, because of that song by the Village People, of course.

No, actually, there was never any question about which branch of the service I wanted to join. I joined the navy because I wanted to get as far away from the desert as I possibly could.

I went home on leave when I got a chance, and I always saw Jimmy whenever I went back. On my second visit, I found out that Beck and Sal had hauled stakes and split for California a few months after I'd left for boot camp. Not on foot, either. They'd stolen their dad's monster pickup, but rumor had it their dad never even swore out a complaint about the theft of his truck. Maybe he figured it was a small price to pay to get rid of his sons for good. Or maybe the truck wasn't empty when they jumped in and

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No, It Was a Red Camaro

My Top 10 real, true, honest-to-God – or this-is-the-way-I-heard it (and where-I-heard-it) – versions of the rocket car story emailed to me since I posted my version on the Web:

The ride of the rocket car …

10. … took place sometime prior to 1967, somewhere near Fort Gordon, an Army post in Georgia.

9. … originated in the '50s and '60s, when race car driver and designer Andy Granatelli toured the state-fair circuit in a JATO-powered car.

8. … involved a green Plymouth Roadrunner that crashed into one of the walls alongside the Hassayampa River about a mile north of Morristown, Arizona.

7. … involved a Model T Ford that someone attached a rocket to, then fired in the Mojave Desert.

6. … evolved from an advertising stunt staged by Chrysler in 1970, in which a car was fitted with rockets to demonstrate the amazing power of the featured car's brakes.

5. … took place in the late '70s, when a pair of USAF mechanics in Oregon stuck an F-16 engine on the back of a Ford Pinto.

4. … was really about a Plymouth station wagon fitted with an outdated ICBM engine near Fort Hood, Texas.

3. … happened late one night in the '40s or early '50s, when someone mounted a JATO bottle in the trunk of a Buick, took it out to US 50 (just west of Kansas City, Kansas), and ended up wrapped around an oak tree.

2. … took place in 1975 on the Pacific Coast Highway.

1. … was actually a rumor that began after a Lincoln Town Car crashed while trying to set a world's record for the longest automobile jump.

headed west. Their dad was still up to unknown hanky-panky out in the desert somewhere. Beck and Sal may have waited for an occasion where Dad brought some work home with him and headed for California with a few bales of Colombian contraband in the bed.

Whatever the case, nobody ever found out. The next update I got on *that* situation was the following Christmas. My dad told me that Beck had been busted in California for God-only-knew-what and had died in prison. The facts were sketchy, but I didn't press details. Dad obviously considered it a case of "good riddance" but didn't actually say the words, because he knew Beck had been a friend.

Sal was MIA, and as far as I know, nobody heard from him again. But without Beck to take care of him, it's doubtful that he came to a good end.

So that leaves Jimmy. He finished college, got his degree, and started working for a big company, designing various kinds of equipment. I don't want to specify the company, or even the exact type of equipment. Let's just say that you'd recognize the company name if I mentioned it, and Jimmy is head of the department that builds machines for making cold things hot and hot things cold. If that's not good enough for you, too bad.

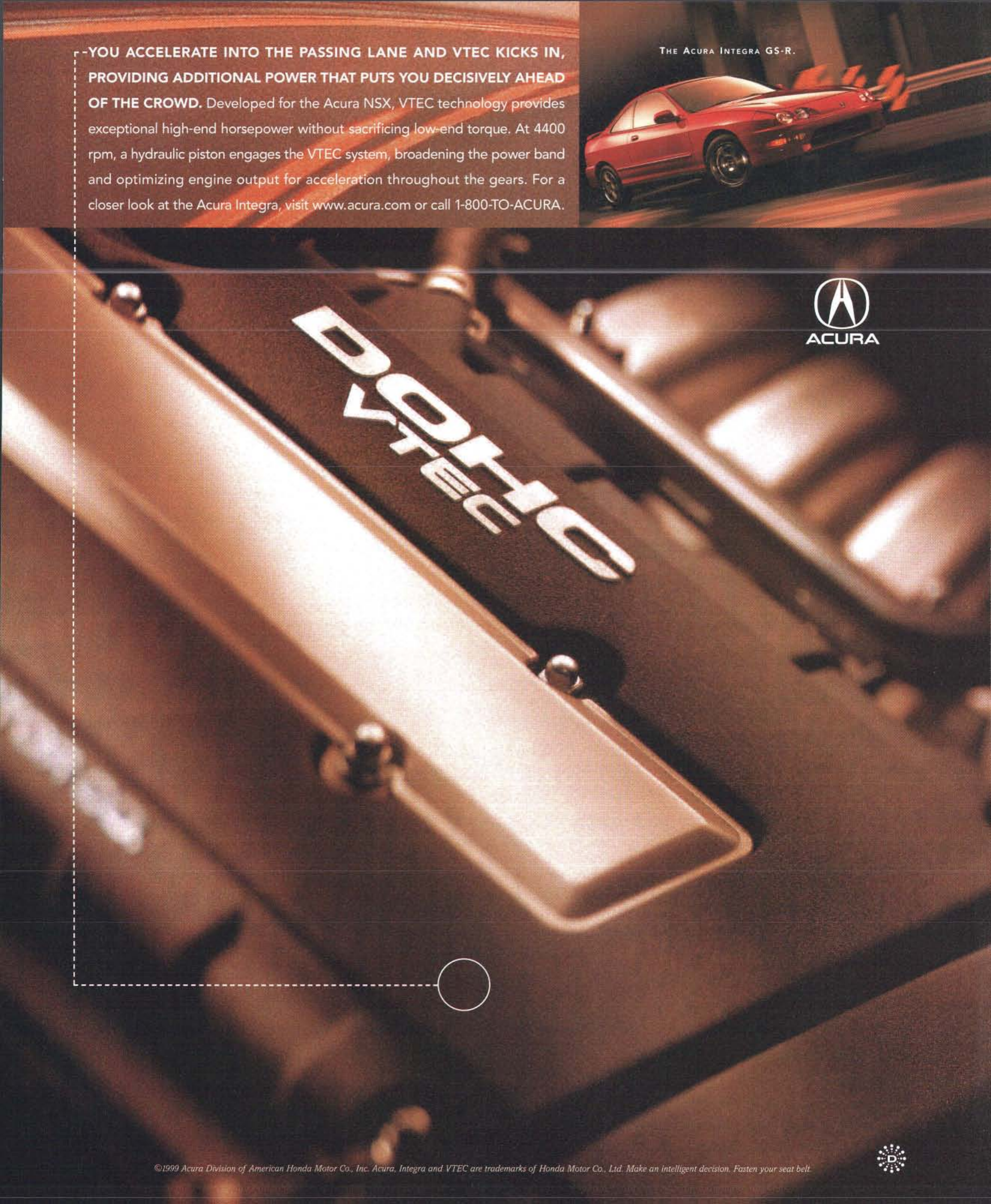
My dad kept the scrapyard, continued going to auctions and making a profit, all the way up until he retired last year. He and Mom moved to Phoenix, where they're probably the only retired couple who don't complain about the heat. They came up to visit a few months ago, to see my wife and me and the kids, and while they were here I took my dad out one night to shoot some pool. I told him the story of the rocket car, not knowing what his reaction would be. He laughed so hard I thought I'd end up having to call the paramedics. Seems that over the years he'd heard various bullshit artists mention a car driven into a cliff, but he'd always dismissed it as just another stupid story.

I've stayed in touch with Jimmy over the years – he's met my family and I've met his, and we've exchanged the occasional phone call and Christmas card. He never forgot about the rocket car, and over the years he's taken great joy in tweaking my balls about it. Every now and then I get something in the mail to remind me of the whole thing, something Jimmy thinks I'll find funny. At first it was just the odd newspaper clipping or magazine article, but once VCRs became popular, he started sending videotapes. And even though there was never a note or explanation with a tape he sent, I always knew what to look for when I watched the movie. One was *The Right Stuff*, and I laughed out loud when scenes of the rocket-sled tests came on the screen. Another was more recent, a Charlie Sheen flick called *Terminal Velocity*. Sure enough, there was a scene where Charlie and some blond bimbo escape from the bad guys in a homemade rocket sled.

The one movie he sent that I *didn't* find very amusing came a few years ago, at a point where I hadn't heard anything from Jimmy in a long time. This was the third part of a three-movie series. And although I'd seen the first one a couple of times, I'd never seen the second part. So I had to rent Part II at the video store down the street, which I watched with my family one Friday night. The next day my wife took the kids to visit her parents, and I stayed home and put Jimmy's movie in the VCR. The part at the beginning of the movie, where Doc Brown and Marty McFly find the DeLorean in the abandoned mine shaft was bad enough. But toward the end, when they mounted railroad wheels on the time machine and pushed it down the tracks with the locomotive …

When the movie was over, I got up close to the TV and read each and every name in the credits. After all, we never *had* found out what happened to Sal after he was left on his own in California. ■ ■ ■

ILLUSTRATION: MATT MADDEN



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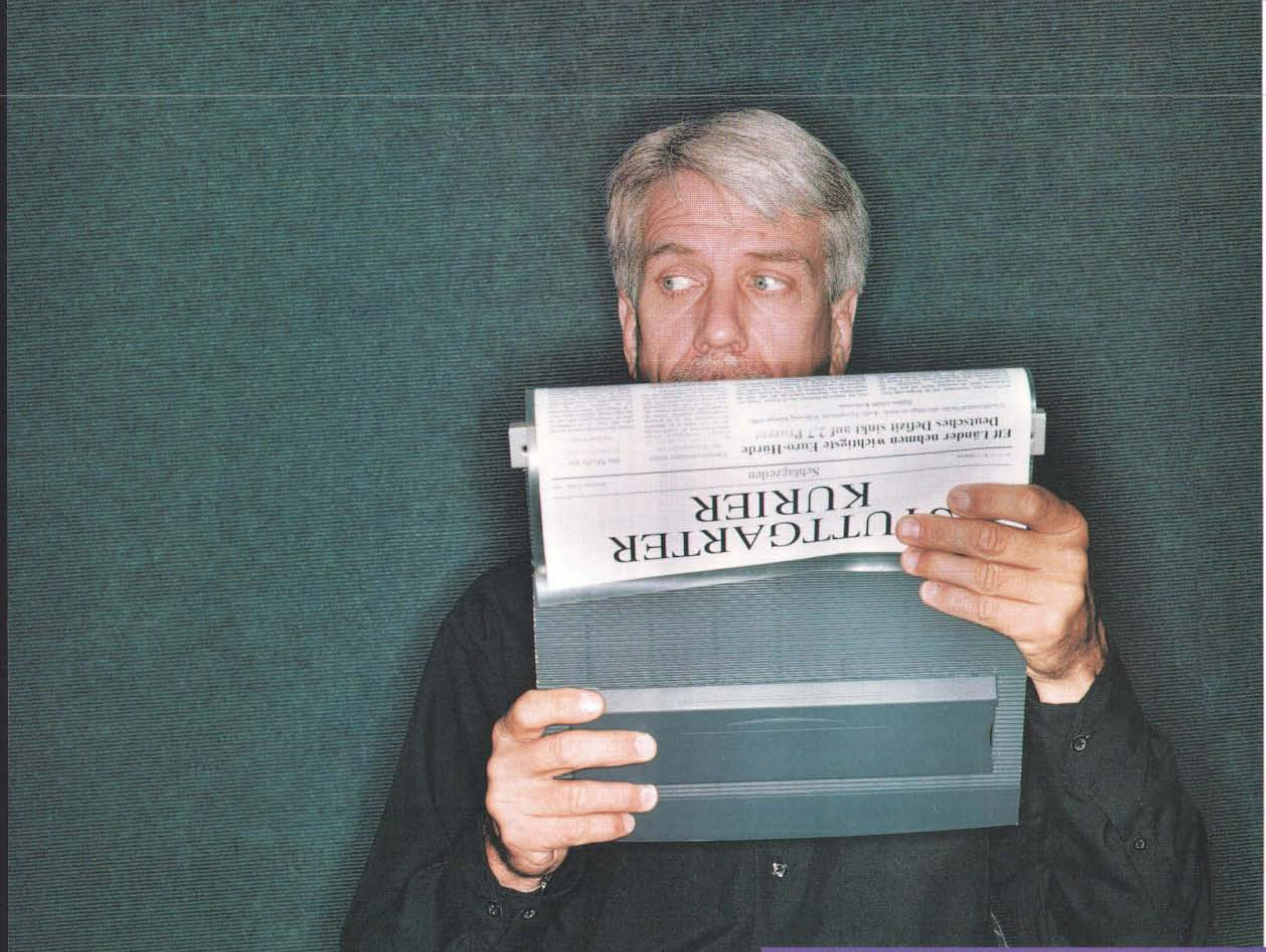

IBM designer Bob Steinbugler scans the newspaper of the future.

PHOTOGRAPH: EVAN KAFKA

News Flash

Scrap the presses – print and the Web are racing toward the biggest media merger in history.

By Paul Kunkel

With the 21st century humming along, why is it that you're still reading the morning news on big, crinkly pages of dead tree?

Simple: Because the good old newspaper, flaws and all, remains the handiest user interface around for delivering a mountain of information in a portable format. A typical weekday edition of *The New York Times* contains about 200,000 words – but it's small and malleable enough that, whenever necessary, you can easily fold it under your arm and run for your flight.

All the same, it's easy to imagine ways technology could improve the form, which is precisely what Bob Steinbugler has been doing for the past few years.

Steinbugler, 49, heads IBM's Corporate Strategic Design Program in Raleigh, North Carolina, and he's the main brain behind the eNewspaper, Big Blue's prototype for an electronic media device that, he believes, will start invading the turf of traditional papers in four to five years. Steinbugler isn't talking about two-line news items flashing across the screen of a handheld, either. The digital newspaper he envisions will represent a real revolution. Printed on pages as flexible as newsprint and as fast as the Net, it will look like a Jetsonized version of today's daily, with columns of stories, photos, and headlines in traditional journalistic typefaces, all delivered in spiffy take-it-anywhere form. But enewspapers will venture beyond the disposable pulp rags of today, serving up real-time

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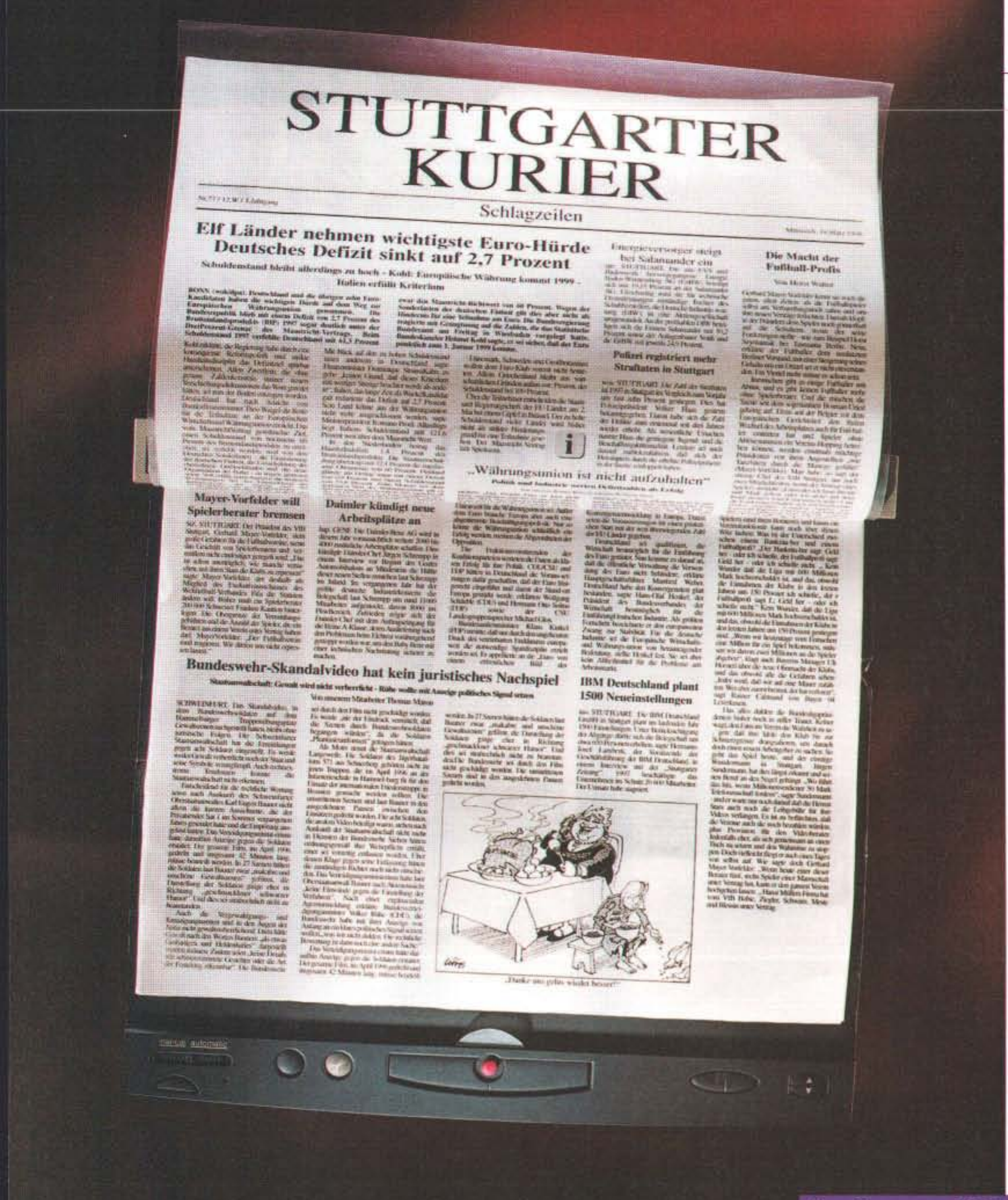

STUTTGARTER KURIER

Schlagzeilen

Elf Länder nehmen wichtigste Euro-Hürde
Deutsches Defizit sinkt auf 2,7 Prozent

Schuldenstand bleibt allerdings zu hoch - Kohl: Europäische Währung kommt 1999 - Italien erfüllt Kriterium

Energieversorger steigt bei Salamander ein

Die Macht der Fußball-Profis

Polizei registriert mehr Straftaten in Stuttgart

„Währungsunion ist nicht aufzuhalten"

Mayer-Vorfelder will Spielerberater bremsen

Daimler kündigt neue Arbeitsplätze an

Bundeswehr-Skandalvideo hat kein juristisches Nachspiel

Staatsanwaltschaft: Gewalt wird nicht verherrlicht - Rühe wollte mit Anzeige politisches Signal setzen

IBM Deutschland plant 1500 Neueinstellungen

The eNewspaper, IBM's foldable, updatable, 8-page, 300-Mbyte prototype.

stock quotes and stories as rapidly as CNN. Enewspapers will go so far beyond the familiar format, in fact, that they'll become a hybrid medium - part print, part Web, part broadcast.

Steinbugler unveiled a nonworking prototype, with dummy plastic pages, at "IBM Design Innovation - Past, Present, Future," an exhibition that opened at Internationales Design Zentrum in Berlin last summer. Displayed alongside existing devices like the ThinkPad, the eNewspaper might easily have been laughed off as a pie-in-the-sky concept. But the response was immediate, and surprised even Steinbugler, who's been designing over-the-horizon concepts at IBM's Research Triangle Park for years.

The prototype vaguely resembled three-ring binder, with eight flexible, double-sided pages bound by an aluminum spine. The device contained a circuit board, a battery, a USB port, and a slot for a matchbook-sized 300-Mbyte Microdrive large enough to store hundreds of newspapers. Steinbugler says a working eNewspaper could receive content during the night through a Net-accessible docking station, then get wireless updates throughout the day. All the news you want, with no paper, no ink, no delay.

The key to turning this vision into reality: digital ink made of tiny, mutable "pixels" half the width of a human hair. The material is as essential to Steinbugler's concept as newsprint is to the *Times*, and several companies are in a high-speed R&D rush to create it. Scientists at Xerox PARC, in partnership with 3M, have already produced an electronic-paper prototype with the contrast and resolution of a printed page. Yet this paper doesn't quite go far enough: You can write on it, but it can't rewrite itself. Two other efforts are under way to develop a paperlike screen that would display information dynamically, loading page after page of your enewspaper. The first involves E Ink Inc., an MIT Media Lab spin-off based in Cambridge, Massachusetts, that has deep pockets and publishing-heavyweight investors such as Hearst. And then there's IBM, which launched its formal enewspaper effort several years after PARC and E Ink, but has taken the most aggressive all-systems-go approach.

PHOTOGRAPHS: EVAN KAFKA

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In a few years, these digital pages should move from lab to factory to market. And the technology is real enough that media companies are starting to prepare for it now, although – like everybody – they're uncertain about which "delivery" format will win out in the end. No publisher can predict with any certainty whether the next generation of digital media devices will look like a PDA, an ebook (essentially an oversize PDA), or some as-yet-unnamed gizmo like Steinbugler's eNewspaper. But publishers are convinced that digital media won't stop at the desktop.

By late 2001, 3M will be churning out **Electronic Reusable Paper** that can be used an infinite number of times – a sort of flexible **Etch A Sketch**.

"It's time-will-tell mode," says Jessica Perry, VP of business development at Dow Jones Interactive Publishing, the digital arm of *The Wall Street Journal*. "We're starting to refine our strategy and will move quickly, because the market will evolve quickly." The *Journal* already delivers news through AT&T Wireless and AvantGo, and in May announced a deal with Peanut Press, a division of the ebook venture netLibrary, to begin distributing content to handhelds.

Late last year, Time Inc. – the largest magazine publisher in the US – began to hold meetings to plot its digital course. "Time is exploring any and all possibilities," says one person involved, "because the assumption is that whatever we have today isn't the thing we're going to have five years from now."

Other companies have seen a similar future. Havas (one of the world's largest media groups), Central Newspapers (a small Phoenix-based chain), and Gruppo Espresso in Italy are all awaiting a world of digital paper; and all invested in E Ink's $37 million second round. Surveying such developments, Steve Dienna, Steinbugler's colleague in the media and entertainment sector at IBM, says: "A digital reading device that can substitute for a newspaper, magazine, or book – publishers see this coming, and they don't want to take second place as they did with the Web."

Steinbugler talks even bigger. "We've reached a critical mass," he says, relating an anecdote about a call he received last year from Fletcher Challenge, the largest newsprint manufacturer in Asia. The company's owners, aware of enewspaper research developments, asked him about the wisdom of building a new billion-dollar paper mill. Did it make sense to invest so much in a pulp-textured tomorrow?

"Yes," Steinbugler told them, "but don't build another without asking us first. Because when epaper takes hold, the transition will happen quickly. The newspaper as we know it will continue to exist, but it will become a vestigial thing."

Of course, such miracles were supposed to happen long ago. The dream of enewspapers dates back to 1975, when a young physicist named Nicholas Sheridon, a graduate of Wayne State University, joined Xerox PARC, and set out to invent digital paper. "Back then, everyone at PARC wanted to replace printed paper with portable flat-panel displays," recalls Sheridon, now 64 and a PARC senior research fellow. "But displays at that time were so poor you had to dim the lights in order to see anything at all." In comparison, Sheridon notes, "the typical magazine contains hundreds of hi-res displays in a robust, inexpensive, portable format that can be read in normal light."

Of course, ink on paper cannot easily be erased or rewritten. Sheridon envisioned a flexible sheet that could be "printed" with an electrostatic charge. The digital paper he came up with consisted of minute electrically activated spheres, floating within the tiny oil-filled cavities of a transparent sheet of elastomer. The rotating microspheres – half-black and half-white – expose their white or black side in response to an electrical field. Sheridon called the material Gyricon, from the Greek word *gyro*, meaning "rotate," and *icon*, meaning "image." He built an initial klugey prototype using glass balls in 1975, patented his Twisting Ball Panel Display in 1978, and predicted it would be ready for market by the mid-'80s. But around that time, competition was heating up in the copier business, and Xerox ordered the young researcher to devote his efforts to the company's core product line.

He didn't return to the project until 1991, when his old patents were on the cusp of expiration. Sheridon and colleagues Ed Richley and Joseph Crowley worked at a feverish pace to secure new patents on the manufacture of Gyricon spheres, Gyricon sheets (in black and white), and several related printing devices: a high-speed desktop machine, a battery-powered stylus, and a handheld wand – resembling an 8-inch plastic ruler with a strip of electrodes on one side – that can erase and rewrite an entire sheet in a swipe.

This time around, PARC – with its tradition of inventing the future but sometimes failing to capitalize on it – has made Gyricon a priority. Last fall, the lab licensed the technology to 3M, which has produced test samples with 200-dpi resolution and roughly the same contrast as ink on paper. Now 3M is fine-tuning the tricky manufacturing process for the microspheres: 100-micron-wide beads made of two kinds of ferroplastic with contrasting color and opposite polarity. The beads must be exactly the same size and exactly 50 percent white and 50 percent black in order to produce sheets with acceptable contrast. And 3M must make approximately 100,000 beads per page.

Still, 3M project leader Dave Engler says that by late 2001, the company will be churning out Electronic Reusable Paper and shipping it off to schools and offices. An 8½- by 11-inch sheet will cost far more than a page of the old stuff, but the epaper will be usable an infinite number of times – a sort of flexible Etch A Sketch without the awkward knobs. You can write and rewrite on it, just the way Sheridon envisioned. And as the first epaper to reach the manufacturing stage, it's upped the reality score for digital paper across the board.

Meanwhile, Joseph Jacobson – a young MIT physicist who launched his own epaper project in 1993 – is working out the glitches in his technology. (See "Digital Ink," *Wired* 5.05, page 162.) Four years after he began the research, and with two patents in hand, Jacobson and three partners founded E Ink. Today, the company counts more than 60

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patents pending, along with $52.9 million in funding from VC firms, media companies, and tech giants such as Motorola.

E Ink's mission of "shattering the glass curtain" includes plans for everything from digital signboards to paperlike screens, though the latter - the stuff of enewspapers - lies several years out. So far, the company has produced the Immedia display, an ultrathin, remote-controllable, in-store signboard. By tackling the signage market first, E Ink has been able to work out its technical problems on a giant scale. Or at least that's the plan - judging from E Ink's first billboards, the company has a few contrast and resolution problems to work through. To make the leap from signs to epaper, E Ink will need to shrink the billboard's 1- to 2-square-centimeter pixels down to 100 microns. And to take the final step from static epaper to a dynamic display, the company also needs to develop a flexible thin-film transistor (TFT). This is the reason for E Ink's 1999 partnership with Lucent Technologies' Bell Labs, the Murray Hill, New Jersey, research center.

Tomorrow's epaper will be a far cry from an ebook: "The last person to enjoy reading **from a tablet** was Moses. Clearly, the **existing design is wrong.**"

All laptop screens depend on a TFT, the layer of technology behind every LCD display that switches pixels on and off. Traditionally, TFTs are made by spreading amorphous silicon (a semiconductor) on a substrate of glass. However, the silicon-on-glass tech doesn't make for a very flexible display. Plastic, which is flexible, would be melted by the 680-degree-Fahrenheit temperatures needed to process the amorphous silicon. For years, scientists have searched for an alternative semiconductor that would cost less and be easier to work with. Just after its deal with E Ink, Lucent's lab announced a breakthrough: new ways to manufacture and purify a material called alpha-6T that conducts electricity as efficiently as amorphous silicon, but can be processed at room temperature.

Seven years after Jacobson launched his research, the scientist has left E Ink in the hands of his partners and returned to his MIT lab. E Ink is still at least two years from delivering its digital paper, and the company's greatest achievement may actually be its partner's: Lucent plans to have a working prototype of a flexible TFT by October at the latest.

Entering the fray after 3M and E Ink, not to mention Xerox PARC, IBM is in some ways the dark horse of the story. The digital newsprint in development at Big Blue combines a flexible TFT similar to Lucent's with a "paper" made of organic LED (oLED for short). The technology is composed of organic polymer and fluorescent dye layers less than 0.2 microns thick, sandwiched between two electrodes (the top one is transparent). A steady current from the electrodes excites the polymer molecules, causing them to emit a pure, flicker-free light. With a viewing angle of 160 degrees, oLEDs are as readable as paper. And the technology has one big advantage over manufactured pixels such as E Ink or Gyricon: The organic materials can be deposited easily on a surface of any size. Moreover, oLED screens suck up about half the power of an equivalent active-matrix LCD.

John Campbell Scott, at IBM's Almaden Research Center in San Jose, started looking into oLEDs six years ago. In 1995, he caught wind of a parallel research effort at the IBM lab in Zurich, and together the two groups of scientists produced a working oLED panel of 640 x 480 pixels. Each pixel measures 18 microns square, about one-fourth the size of the smallest E Ink or Gyricon microsphere. Actually, each pixel is composed of three "subpixels" that deliver true RGB color at better than 200-dpi resolution. "Other companies are already commercializing very simple oLED displays," Campbell Scott points out, citing a Pioneer car radio and soon-to-be-released Motorola cell phones - both using technology licensed from Kodak (which invented oLED in 1987). To gain the edge, IBM will have to move fast. Kodak says that early next year it will release the first commercial samples of a 5.5-inch oLED, coupled with a low-temperature silicon TFT made by Sanyo. "Scaling up to page size will be straightforward," says John Burtis, research associate at Kodak R&D. "And we definitely have our eye on a flexible version." Estimated time for delivery: "Two years or a bit more."

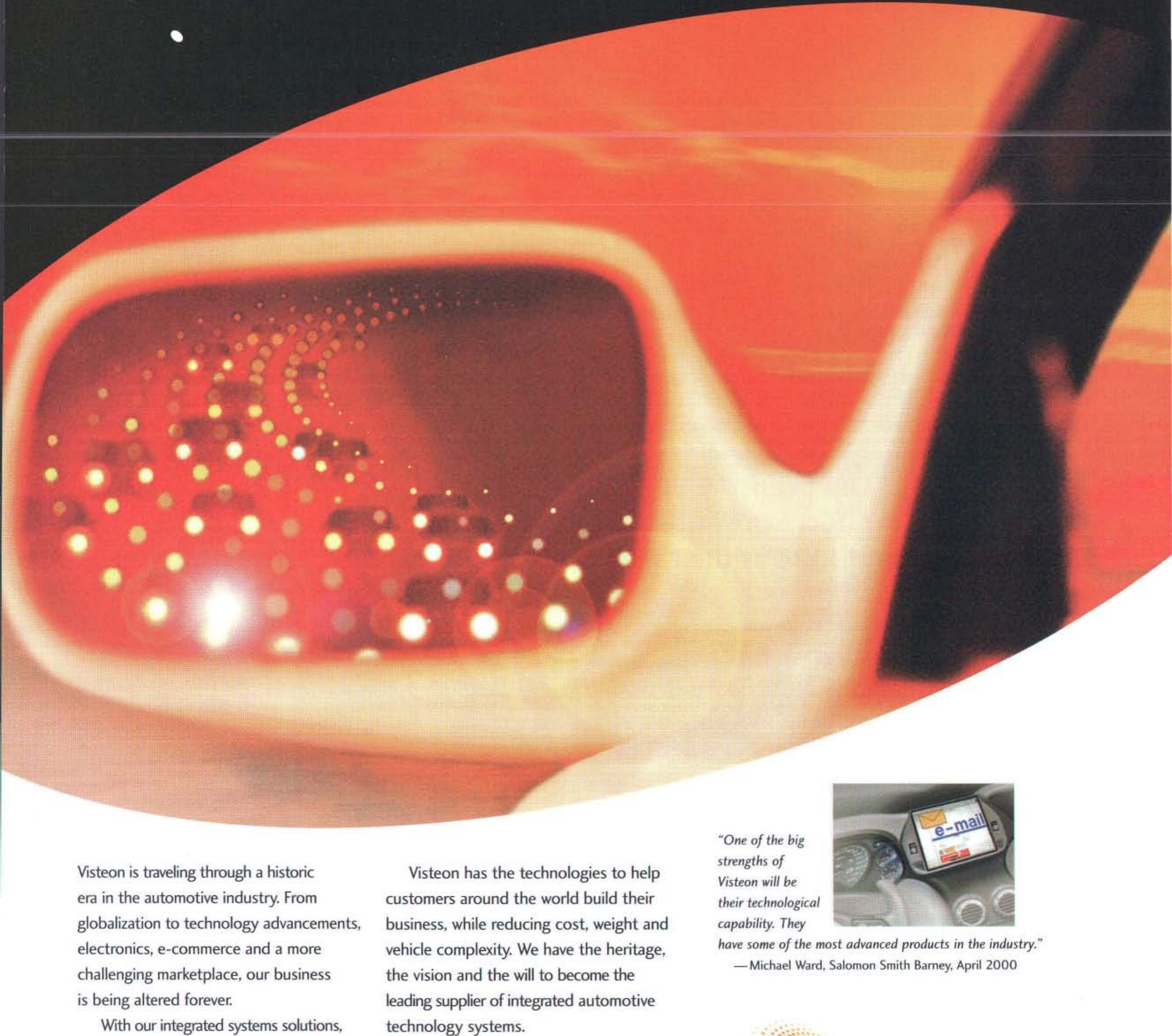
By the time Campbell Scott's foldable-as-paper oLED is market-ready, a thin-film transistor able to control the oLED will be in advanced development, say Cherie Kagan and Christos Dimitrakopoulos, materials scientists at IBM's Thomas J. Watson Research Lab in Yorktown Heights, New York. Working in a windowless, 20- by 40-foot space at the lab's organic electronics group, researchers are combining unnamed (and secret) polymers with inorganic materials, purifying the mixture, and, in the sterile environment of the vacuum chambers, depositing it onto a plastic substrate.

In 1999, after repeated trials, the Watson team made a breakthrough in the form of an organic/inorganic compound that can be applied to transparent plastic in liquid form at room temperature. The liquid evaporates and then the inorganic and organic materials self-assemble, alternating layers, to form perovskite - a crystal with the properties of a semiconductor. "This approach is pretty radical for the display industry, but it makes perfect sense to a chemist," says Kagan. "We let nature do the work for us." The result? TFTs that are easy to manufacture in any size and for less than one-tenth the production cost of a silicon-based TFT.

IBM's digital newsprint technologies are still at least three years from production, but IBM has pushed ahead nonetheless, developing product concepts like the eNewspaper. Working with a handful of designers, Steinbugler has produced six nonworking prototypes, all meant to show IBM's publishing partners what the future will be like.

"Until now, all ebooks have been tablets," he says. "But the last person to enjoy reading from a tablet was Moses." Market data support his claim: 1999 sales of the Rocket, SoftBook, and all other tablet ebooks totaled only 5,000 units, by IDC estimates. "Clearly," Steinbugler argues, "the existing design is wrong." To do better, the IBM team launched a detailed study of what people actually do with newspapers, from how and where they

MOVING FROM A PROUD PAST TO A PROMISING TOMORROW.



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read them to how they tuck them under their arms. Led by then-visiting designer Sofia Galbraith, the study ranged from on-the-street (and in-the-subway) observations to interviews with newspaper companies about how much content they put into each section and why. Based on their findings, the designers created a prototype with eight double-sided sheets, enough to display the average newspaper section.

"People want to scan an entire page at once and see many stories at a glance - not the one page/one story format of the Web," Steinbugler reports, adding that the eNewspaper could be read in a confined space, such as an airline seat or commuter train, or spread out on the kitchen table. Lead stories will begin on page one and have a jump indicator, because that's what people expect. "We could have designed our prototype with only two pages," says Steinbugler, "forcing readers to scroll through stories, as they do on a computer, and to push a button to redraw each page." But research suggested that this approach was not newspapery enough.

"We will look back on **print media** the way we look back on **travel by horse** or wind-powered ship … as relevant to our future as the **carrier pigeon**."

"One of the benefits of reading a newspaper - whether it's digital or trucks-and-trees - is the serendipity," agrees Jessica Perry of Dow Jones. "You never know what you're going to get when you turn the page."

"Reading is a private ritual that is powerful yet mysterious," Steinbugler says. "If we respect the mystery and create the right enabling technology, the potential is huge." He has glimpsed that potential. Within days of the Design Zentrum exhibition where he introduced the eNewspaper, a German newspaper consortium offered to fund development of IBM's design in exchange for a licensing agreement. Since then, more than 250 media and technology companies, including the Japanese giants Asahi and Nikkei and several European concerns, have contacted IBM with questions about content formats, copyright protection, and the information-management systems that will underlie a global e-publishing industry.

These are the solutions IBM wants to provide, explains design chief Lee Green. "We may not want to manufacture flexible displays or products like enewspapers ourselves," he says, adding that IBM is happy to leave the assembly line to someone else. Though the company isn't ready to sign any licensing deals yet, several firms are interested, including LG Electronics, the Korean chaebol with $10.9 billion in annual revenue and interests ranging from VCRs to vacuum cleaners.

For IBM, developing epaper and even the eNewspaper concept are interim steps in the larger task of providing the backend technologies of digital publishing. Based on the IBM software used by Sony, BMG, and others to distribute copyrighted music online, the company's new Electronic Media Management System can prepare and distribute copyrighted content over the Net, track sales, specify usage (from one-time to unlimited), and prevent unauthorized duplication.

"Every newspaper and print media company in the world wants to know how to publish digitally," says Steve Dienna of IBM's global media and entertainment arm. Dienna lives on the road - or rather, in the air - flying from Tokyo to Sydney to Paris to Seoul, talking to media companies about the near future of digital publishing. Steinbugler's prototypes, which Dienna uses to hook audiences, are equally well traveled.

"Asian and European publishers are most receptive," he says, noting how quickly both cultures adopted the mobile phone, and how those established standards will pave the way for wireless data delivery. "But newspapers and magazines everywhere will clean up."

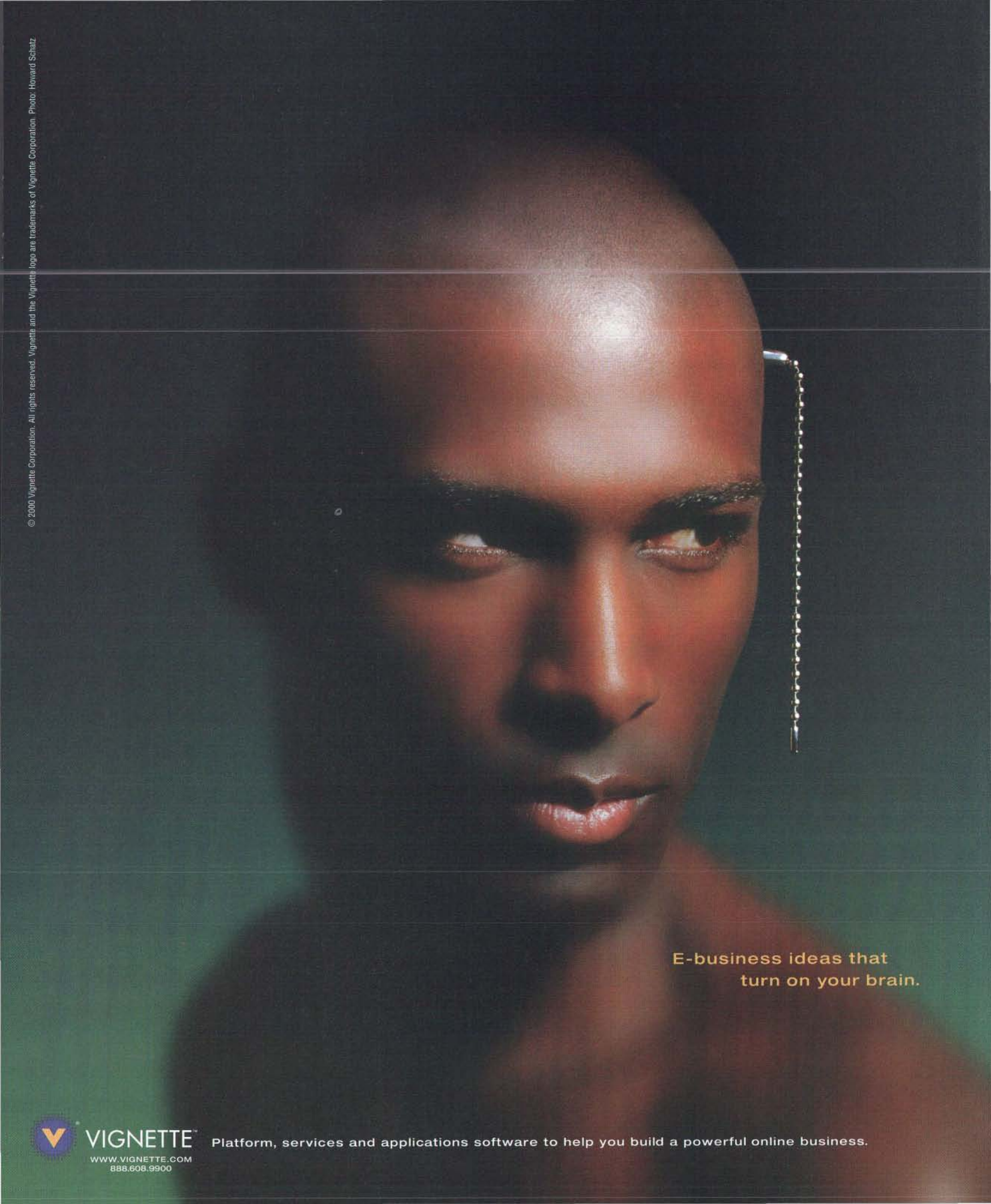
These days, newspapers are looking for new ways to clean up. "The traditional models of revenue generation are already changing," notes Woody Johnson, CIO of the Copyright Clearance Center. Based in Danvers, Massachusetts, the CCC is a digital-rights management service launched in 1978 to handle the problems posed by rampant photocopying. Today, the organization has relationships with more than 9,600 publishers and handles the myriad issues posed by the Net and digital media. Last spring, CCC announced partnerships with both Dow Jones and the New York Times Company.

In the past decade, newspaper publishers have felt squeezed between the Net and a hard place. Subscriptions and newsstand sales don't come close to meeting production costs. Advertising dollars, which traditionally cover the difference, have been declining as the lucrative classifieds move online, and companies spend their brand-building dollars elsewhere. Panicked by the migration of eyeballs and the flow of ad dollars from newspapers to the Web, publishers - with a few exceptions - now offer their content free online. It's an awkward situation to sell your content and give it away at the same time, but publishers have had little choice. The tantalizing solution to this problem: digital newspapers, a medium that bridges pulp and the Web, reuniting readers and ad money while avoiding the biggest expenses of traditional publishing. Although magazine publishers don't have the same advertising problems, the big picture is the same: Bits are cheaper than atoms.

Moreover, in a world of digital distribution, the reader pays for the essential hardware and connection time that makes it all possible. Initially, industry analysts predict, the market will follow the early cellular model in which the hardware is sold at a loss or given away as part of a service contract. When the market matures, individuals will likely pay for both the readers and the Net access that delivers the content.

For a company like Time Inc., which spent $1 billion in paper, printing, postage, and distribution costs last year, e-publishing is a bottom-line godsend. Time's executive steering committee, formed this year to create the company's ebook strategy, has contemplated a more sweeping digital future, a time when something will fill the space between paper and page views.

"There isn't a natural transference of print-specific content to an electronically driven display device," says Peter Meirs, Time's director of imaging and transmission systems. "Emagazines will have some features of a print magazine and some features that you now find on the Web." Meirs isn't



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just paying lip service; he's thought through the obvious ecommerce and copyright issues, and is grappling with questions of page size and orientation and the relative merits of PDF and XML formats.

"Our strategy remains flexible and will depend on where the hardware goes," says Dan Okrent, Time Inc.'s editor at large. "But there is an urgency to move ahead." In a speech Okrent gave at the Columbia School of Journalism last December, he declared that "all forms of print are dead. Finished. Over.... Twenty, thirty, at the outside, forty years from now, we will look back on the print media the way we look back on travel by horse and carriage, or by wind-powered ship ... as relevant to our future as the carrier pigeon."

No doubt Time Inc.'s sense of urgency is influenced by AOL, which in early 2000 announced plans to buy the old media giant. But other companies feel equally pressed for time. KnightRidder.com president Daniel Finnigan can imagine a product that is neither a manufactured paper nor a Web site. "We've been watching the technologies," he says. "It's not a question of if, but when."

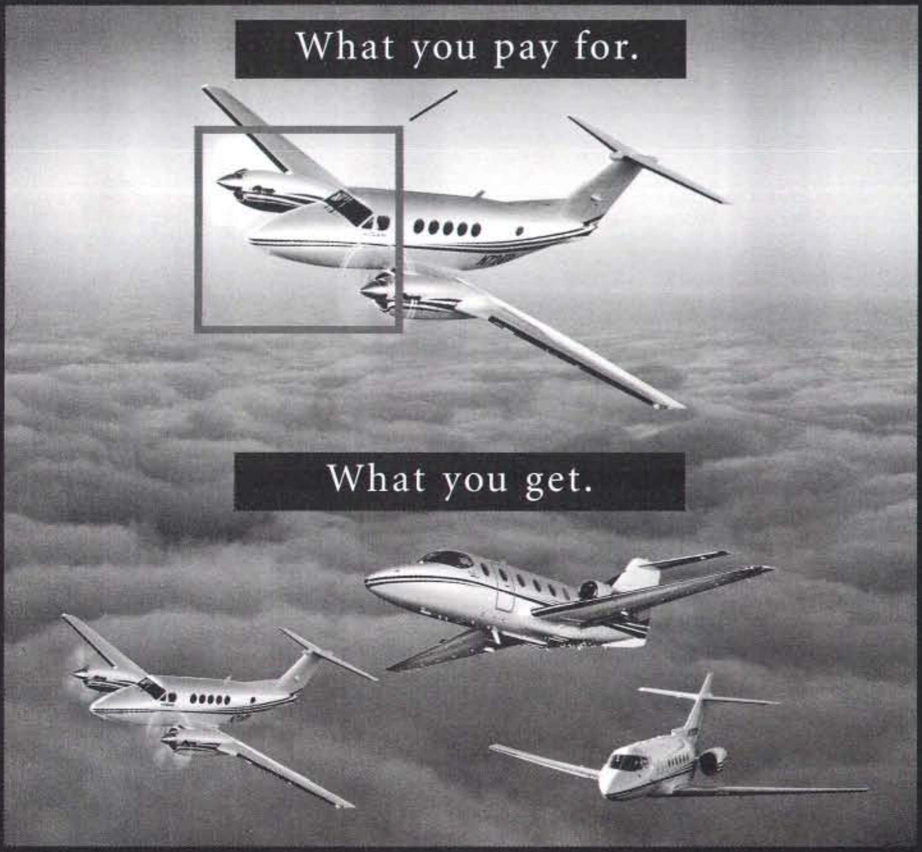
Havas Electronic Content Publishing, the 1-year-old division of the French media giant, plans to have every Havas book, newspaper, and magazine (including *L'Express* and *Le Moniteur*) available in a secure electronic format within three years, when it anticipates the first enewspaper devices will be ready. To speed along development, the company invested $5 million in E Ink and partnered with Microsoft. "Flexible displays will be important to every publisher," says Havas ECP director Minh-Son Nguyen, "because they don't force readers to adapt to new technology. They extend the functionality of reading from books, magazines, and newspapers to a platform that is more powerful, more versatile, yet feels familiar."

That sentiment is echoed by Howard Finberg, VP of CNI Ventures, the investment unit of Central Newspapers, based in Phoenix. "With dynamic flexible displays," he says, "we can have the best of both worlds - the familiar form and feeling of paper, and the immersive quality of constantly streaming information."

Some media organizations still see the newsroom and new media as distinct operations, separate but equal. The New York Times Company is spinning off its digital divisions into independent dotcoms. But enewspapers promise to reverse that trend, or at least blur the distinction. "In the first wave, publishers began putting some content on a Web site," says Time Inc.'s Meirs. "Now I'm seeing a trend toward bridging the mediums, with technologies like Digimarc and GoCode that embed a computer-readable watermark or barcode in a newspaper or magazine page. But the two mediums will eventually grow together. That's the ultimate end of the evolutionary process." (Digimarc is a *Wired* advertising partner using this technology.)

Today's newspapers won't disappear overnight, but the industry will shift as quickly as possible. Inky newsprint will give way to flexible, portable, up-to-the-minute enewspapers. And along the way, the digital divide between new media and old will disappear. ■ ■ ■

Paul Kunkel (digidream@aol.com) *is the author of* Digital Dreams: The Work of the Sony Design Center.



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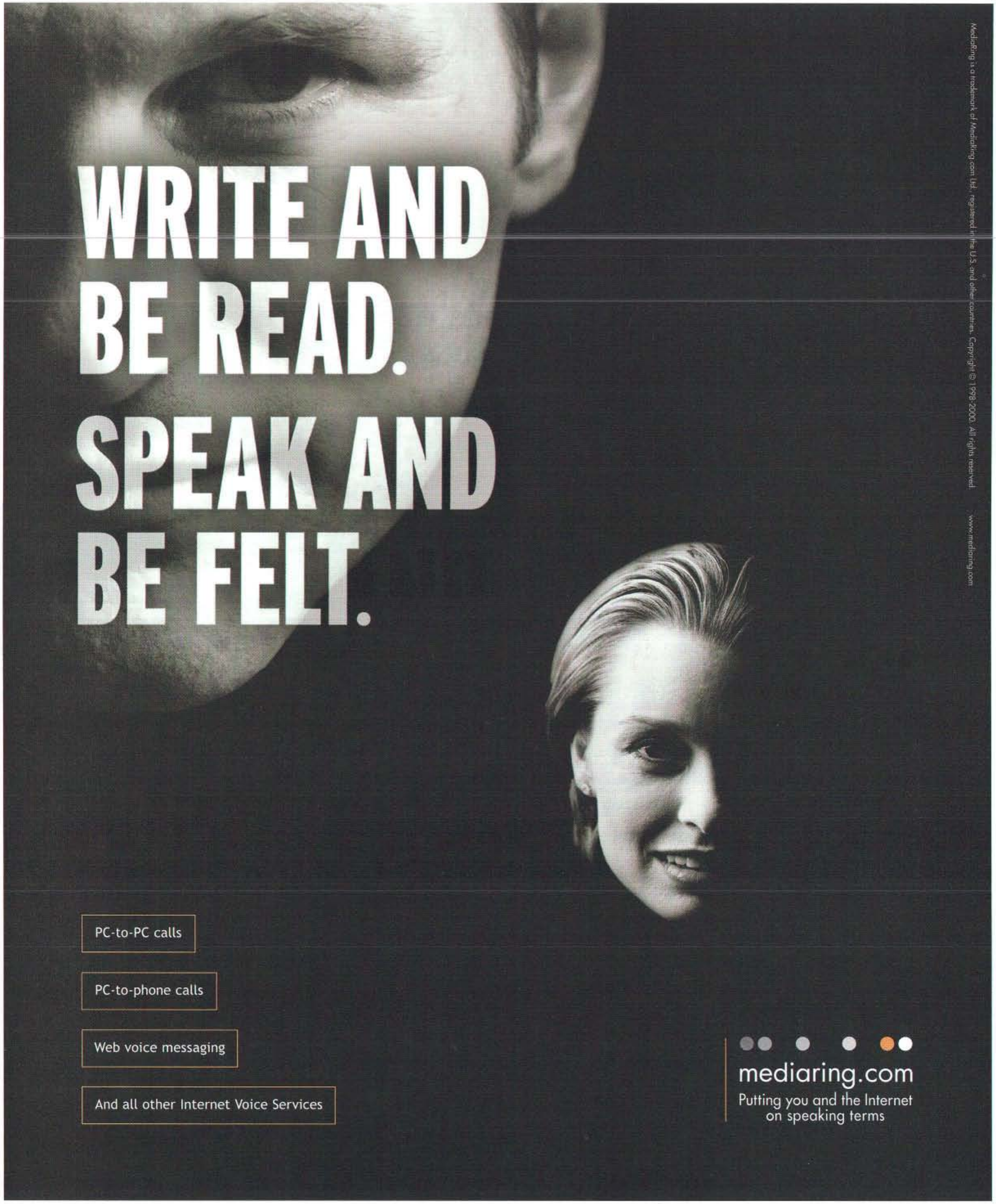

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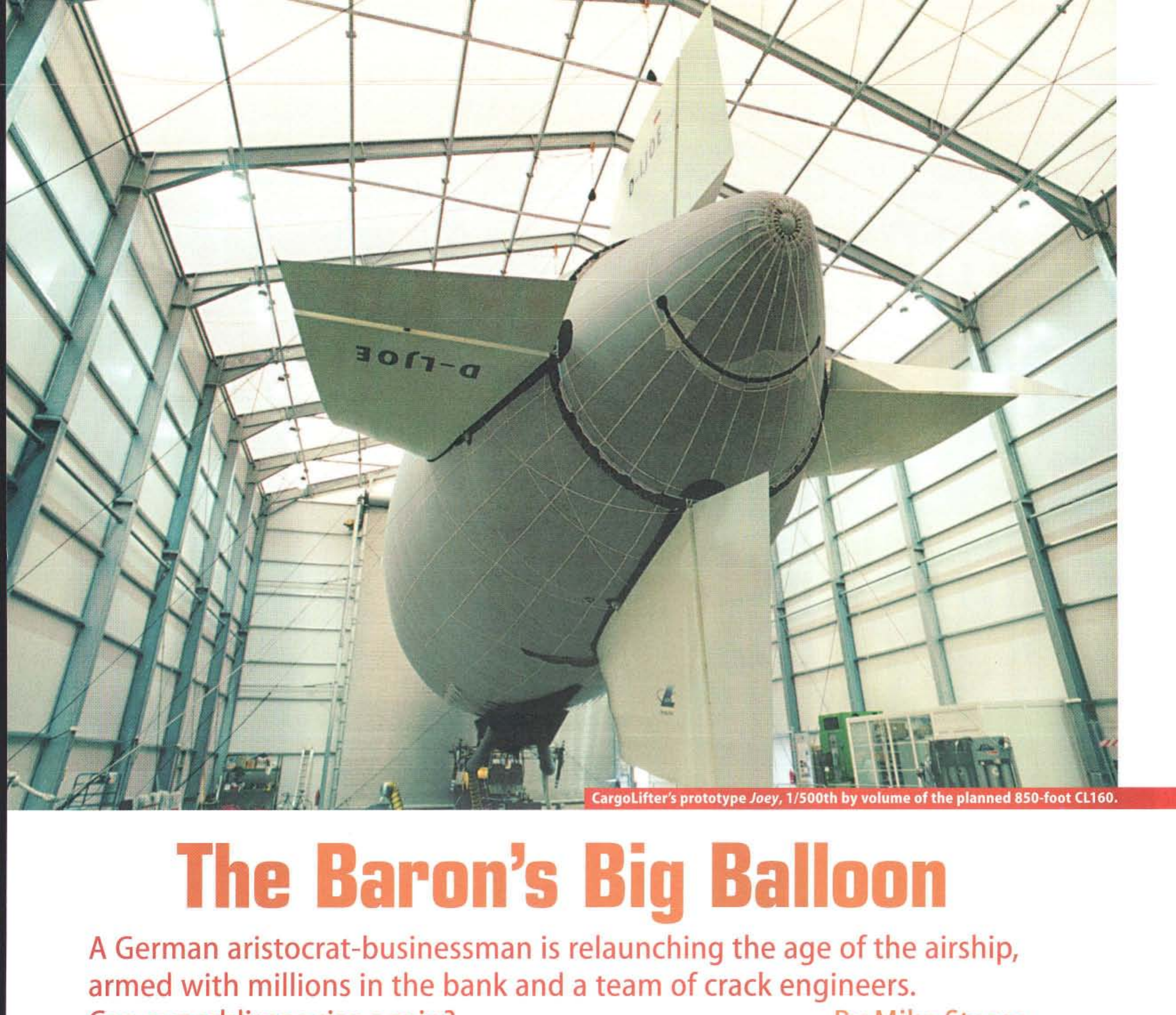

CargoLifter's prototype *Joey*, 1/500th by volume of the planned 850-foot CL160.

PHOTOGRAPH: THOMAS EBERT

The Baron's Big Balloon

A German aristocrat-businessman is relaunching the age of the airship, armed with millions in the bank and a team of crack engineers. Can superblimps rise again?

By Mike Steere

One of the baron's own men said it. The century-old vision of giant, lighter-than-air flying machines has "always ended in tears." They were shed for crashed airships and their victims and for a dream denied - a skyship with the scale and majesty of an oceangoing vessel. When I ask Carl-Heinrich Freiherr von Gablenz, or "Baron" von Gablenz, why he's so sure that his revival of the dream won't also end in tears, he shows me a tight smile. The 48-year-old German aristocrat-businessman - with his dark hair, brown eyes, and splendid jet-black suit - looks more like a *señor* than a *freiherr*. Picture a half brother of Plácido Domingo who didn't get thick in the middle or grow a beard.

He looks up at the sky, then says, "Yes, but there are many kinds of tears." This is a von Gablenz tactic, frequently deployed. He answers the tough questions about his grand project with a riddle, then looks to the heavens as if gazing upon an 850-foot-long, 21-story-high airship called the CL160. My eyes obediently follow his, looking for the big magumba, but all I see is eastern German cumulus.

That's because, so far, the thing doesn't exist, except on the drawing boards at CargoLifter AG, the German company von Gablenz heads. But if everything goes according to plan - and

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The Power of Zero Gravity

Carl-Heinrich von Gablenz, a k a the Baron: CargoLifter's chair, fundraiser, and guiding light.

with a project this grandiose, it probably won't – by 2002 a helium-filled knockwurst the size of an aircraft carrier, the biggest flying machine in history, will take off from where von Gablenz and I now stand. We're located on a 1,000-acre abandoned Soviet airbase near the hamlet of Brand in the former East Germany. This is the CargoLifter Homeport, the Cape Canaveral of the best-funded and most credible lighter-than-air project in 60 years.

In the age of the jumbo jet, the notion of a giant cargo airship plowing through the skies is at once crazy and shrewd, qualities that have prompted an impressive array of aerospace scientists and transportation experts to quit good jobs in the US, Britain, and elsewhere and move to Brand to take part in the baron's irresistible Wagnerian dream. "Germany is the only country in the world that could do something like this," says Tim Smith, CargoLifter's principal research engineer.

Why Germany? Mainly because the nation never quite got over the promise of the *Hindenburg*, the 800-foot luxury zeppelin that blew up in New Jersey in 1937 when its hydrogen lift-gas ignited. Then, in 1996, along came von Gablenz, a kind of Baron von Blimphausen, appealing to national pride, mesmerizing German bankers and government officials with visions of the CL160. It would have 77 times the volume and mass of a Fuji blimp, he told them, making the Japanese dirigible look like a mere soap bubble. The CL160 would weigh 550 tons, and its 16 turbine engines would allow it to travel, between refuelings, a full 6,000 miles at 60 mph, cruising at altitudes as high as 6,000 feet. Its taut white skin could even function as a giant outdoor screen – by day bearing commercial messages, by night showing movies to the crowds below. Von Gablenz explained these things to the businessmen and bureaucrats, and it worked. As of May 30, when CargoLifter went public on the Frankfurt Stock Exchange, the company was worth almost $180 million. Although CargoLifter's closing stock price that day was about 50 cents lower than its opening price, company officials are optimistic that they will raise another $108 million from the IPO.

Von Gablenz and his backers understand that the CL160 is only the beginning of his aero-opera. "We're not just an airship builder. We're here to build a new transport system," he says in his accented but sophisticated English, which he polished in the US. It was at the University of North Carolina, researching logistics, that he hit on a way to solve a vexing bandwidth problem in the planet's transportation web, which moves about 5 billion tons of goods a year. He realized that between the glacial pace of ocean shipping and the weight restraints of air freight, there's a growing need for a new way to move oversize manufactured goods – one that could deliver them quickly and directly. A CargoLifter study estimates that, in the US market alone, shipments heavier than 100 tons and longer than 75 feet are worth $1 billion a year.

Von Gablenz plans a fleet of 50 CL160s (at $50 million apiece) and a transportation network free from the restraints of highways, railroads, and airports. The CL160 would do what no airship – or vehicle of any kind – has ever done: pick up and drop off, from 300 feet in the air, merchandise weighing up to 160 tons and measuring as long as 150 feet, at a cost of about $500,000 for a transatlantic delivery. Although this would be more expensive than ocean shipping, it's a helluva lot faster than a 25-mph container ship – and infinitely cooler. Brobdingnagian objects like power plant turbines and modular disaster-relief hospitals, as well as cement blocks and crates of furniture, would float gracefully through the air, nonstop, to Cameroon and Bangladesh, Manhattan and Long Beach.

A century back, von Zeppelin hoped airships would "erase the advantages of geography" and bring Germany glory – **lofty goals** von Gablenz shares.

This is the reason the CL160 has to be so big, its dimensions determined by simple physics: One cubic yard of helium lifts 1.7 pounds; that means a 160-ton-payload freighter, with a loaded weight of about 550 tons, would have to hold about 19.8 million cubic feet of gas. The CL160 has to be lighter, in relation to its size, than its predecessor, the zeppelin, which could afford to be heavier because it carried people, not equipment. Furthermore, each zeppelin was filled with hydrogen, which can lift 10 percent more weight than helium can.

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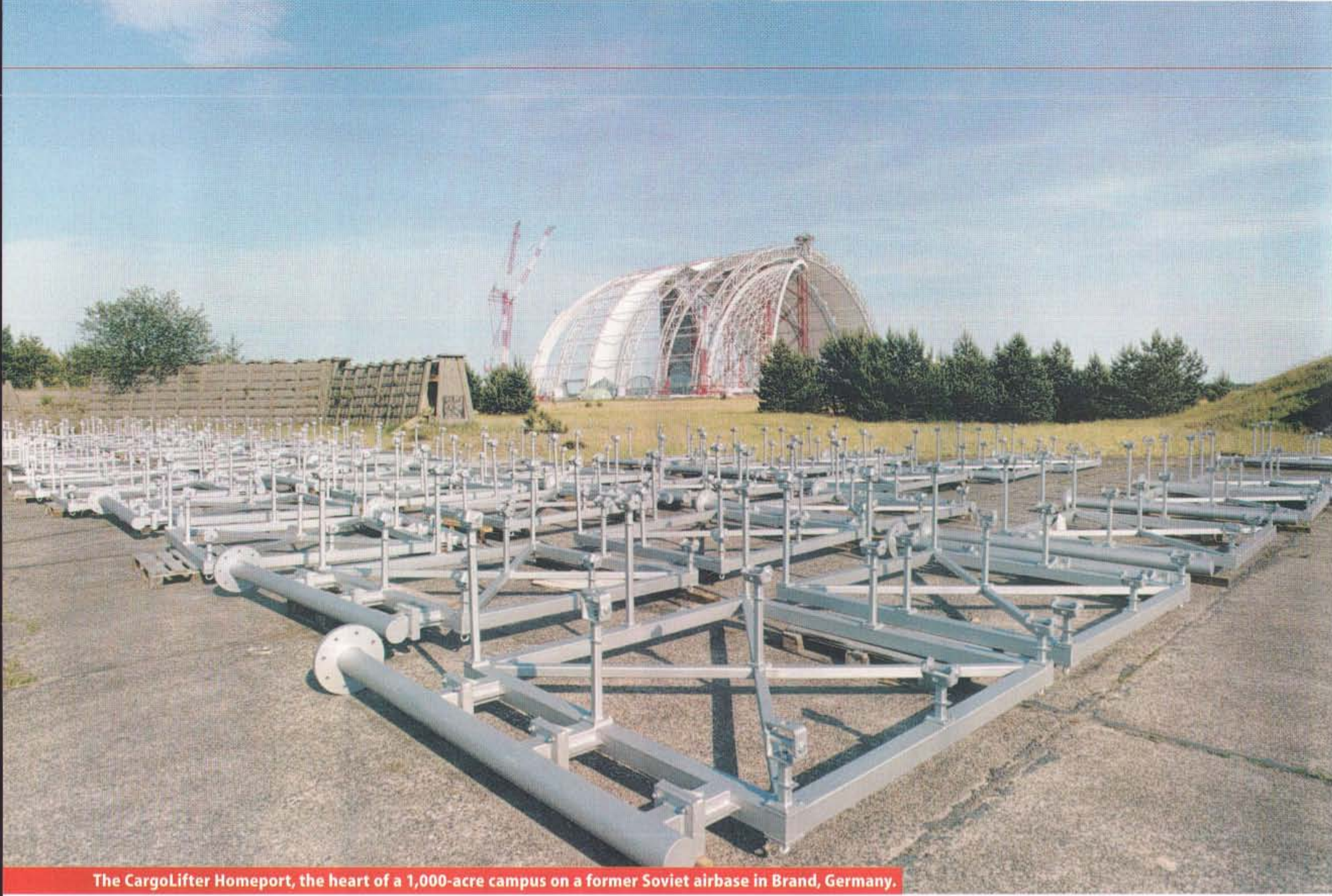

The CargoLifter Homeport, the heart of a 1,000-acre campus on a former Soviet airbase in Brand, Germany.

But this isn't simply a story about size and practical need. It's about new discoveries that may make a technology that once failed us viable again. Von Gablenz passionately believes the world cheated itself when it let big, lighter-than-air craft die. "We were stupid to put this technology in a corner where it's old," he says. "There's no such thing as old technology."

The first airship was also the product of a driven German aristocrat with grandiose ideas. In July 1900, Count Ferdinand von Zeppelin launched his 420-foot, hydrogen-filled *LZ-1* (*Luftschiffe Zeppelin 1*). The count, like von Gablenz, had drastically scaled up the existing lighter-than-air dirigibles, which originated in France in 1852. Von Zeppelin championed the use of gothically complex aluminum endoskeletons that would allow his ships to be 400, 600, and 800 feet long. The count wrote that he built his airships "to erase the advantages or disadvantages of geographical location of nations." No peacenik idealist, he wanted the craft to bring Germany world military dominance, but massacres of zeppelins in World War I would prove him fantastically wrong about their viability as fighting machines.

More significant perhaps was the zeppelins' symbolic appeal. They were the Apollo moon landers of their day, models of German technical ingenuity and know-how, and the metaphorical vehicles for a great national optimism.

When the Zeppelin Company's *LZ-4* crashed in 1908 in the town of Echterdingen, at a time when the count was flat broke, the public was moved to respond to the crisis with a flurry of generous donations. The episode, which brought in 5 million deutschmarks in six weeks (around US$200,000 today), became known as the "Miracle at Echterdingen." Even after the count was dead, ordinary Germans again mobilized in the late 1920s to raise the funds necessary for the Zeppelin Company to build its most ambitious airship, the *Graf Zeppelin*. The country's literary lights – Thomas Mann, Oswald Spengler, and Gerhard Hauptmann among them – flacked for the *Graf*. Hauptmann contributed a poem:

This ship of Gods
which silver-gleaming marries the mist of
    the air,
which seizes German eyes and leads them
    upward,
which unites power and beauty in delight.
Let this symbol rise again.

The 1928 launch of the 775-foot, 36-passenger *Graf* heralded the company's glory days. In 1929, the zeppelin made an around-the-world cruise before settling into intercontinental passenger service, mostly between Germany and South America. Its success – 100 transatlantic flights, 11,929

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The 200-million-cubic-foot hangar, in progress.

passengers, and more than 1 million miles – inspired the company to build the 50-passenger *Hindenburg*. That ship's demise caused the *Graf* to be retired, and ended the short golden age of airships.

Most baby boomers have heard the radio announcer's wail: "Oh the humanity! The humanity!" Some have even seen the film footage of the *Hindenburg*'s crash, which occurred in Lakehurst, New Jersey, on May 6, 1937. Those records of the catastrophe sealed the fate of these airships, even though the *Hindenburg* fire was an anomaly; hydrogen-lift ships rarely ignited.

Even so, Germany had long been cognizant of the gas' potential for combustion, and began negotiating with the US in the 1920s to import helium, which is 7 percent heavier than hydrogen but has the distinct advantage of not blowing up. (At the time, the US controlled the entire world supply of helium.) By 1937, political tensions in Europe prompted the US to hoard the gas, forcing the Germans to fill the *Hindenburg* with hydrogen.

The real crisis, however, was airworthiness. Even before the *Hindenburg*, airships – most of them filled with helium – had been going down with alarming regularity. The US Navy lost 91 men in four crashes during the 1920s and '30s, and thereafter resorted to much smaller blimps, which it used to patrol US coastal waters. In 1930, the British ended their airship program when the *R.101* crashed, killing 38 people. The disaster happened to involve a hydrogen fire, but it broke out only after the vessel was inadvertently steered into the ground. Mats Bäcklin, CargoLifter's chief test pilot, argues that the ships themselves were probably blameless: Hubris was at the root of the problem. "It's like saying the *Titanic* was a bad boat," he says, when in fact, "it was just operated by idiots."

World War II speeded the development of big, ocean-hopping airplanes, and the airship as a passenger vessel no longer made sense. But in the 1960s, a few scientists and engineers, primarily in Britain and America, began to raise the notion of the dirigible as a solution to global-shipping bottlenecks. Forty-year-old documents make the same arguments CargoLifter makes now: using airplanes to freight the heaviest items is implausible, and the sea, rail, and highway shipping arteries are becoming overloaded as the developing world imports and exports more goods. In his popular history *Airships*, published in 1973, historian Robert Jackson writes that old bugaboos about airships no longer apply because, "from the technological point of view, every one of the factors that contributed to airship disasters of the past ... has now been mastered by modern science.... Without exception, the accidents resulted from ... lack of knowledge about weather conditions, technical inefficiency, or the use of explosive hydrogen."

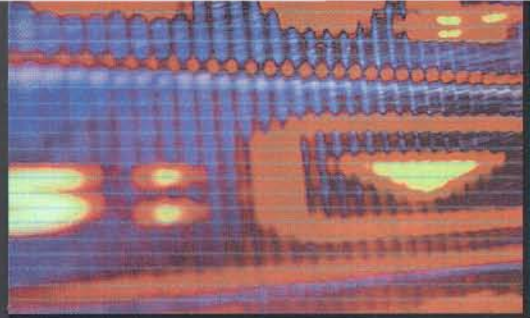
Jackson's book and others of the time examine two then-live British projects, both envisioning airships bigger than the CL160. Neither ship got into the air, nor have subsequent heavy-lift craft, several of them American. In the end, it was a German, spurred on by an insult to his honor, who revived the drive to build a giant blimp.

A mighty architectural statement, the $77 million hangar is a **curving steel-ribbed potato bug** 1,180 feet long, 350 feet high, 690 feet wide.

My first meeting with von Gablenz takes place in one of the prefab, modular buildings plopped down on the CargoLifter campus at Brand. While I'm here, employees begin taking up residence in two airy glass-and-steel buildings that will multiply into a woodsy office complex perfectly suited to the Raleigh-Durham Research Triangle. The resemblance is deliberate; von Gablenz was a researcher at UNC when he did the initial brainwork that led to CargoLifter, and he liked the look of the place.

The first thing he does is try to talk me out of the idea that he is, in fact, a baron. "*Freiherr*, if you translate it, is 'You are free,'" he says, giving me a faceful of sincerity. Yet three dictionaries and everybody I ask beg to differ. It means baron. Possibly,

PHOTOGRAPH: THOMAS EBERT



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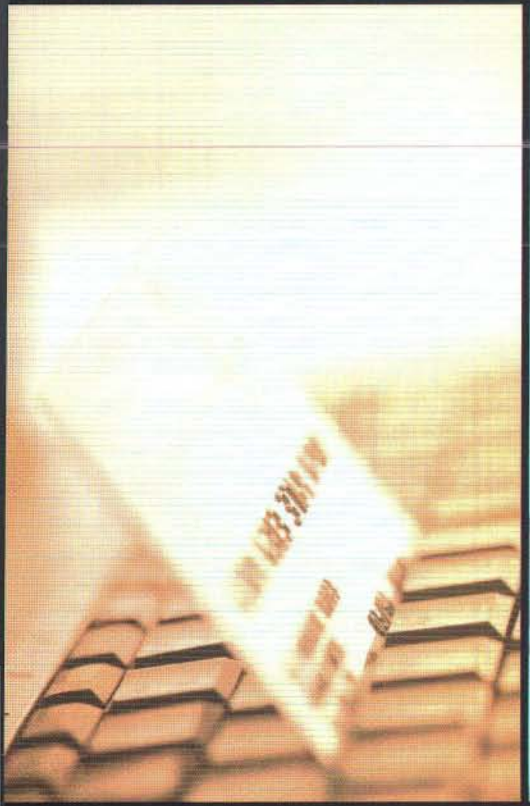

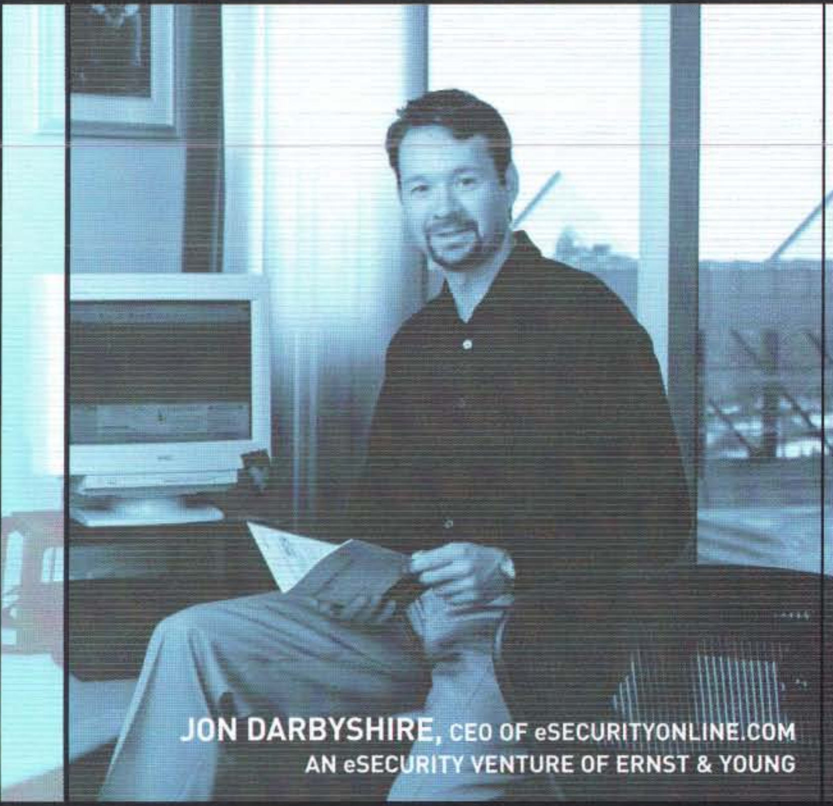

JON DARBYSHIRE, CEO OF eSECURITYONLINE.COM
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SECURITY INNOVATIONS FOR THE NEW ECONOMY

Reliable security is crucial to success in ebusiness. By 2003, US corporations will be spending more than $8.3 billion annually on Internet-security software.* Meanwhile, flaws in such software and hardware are increasingly compromising system protection as hackers refine and propagate their techniques. Jon Darbyshire, CEO of eSecurityOnline.com, an eSecurity Venture of Ernst & Young, recently discussed THE FUTURE OF MANAGING CORPORATE SECURITY.

2,200 KNOWN VULNERABILITIES

Q: Tell us about your new product.

Darbyshire: We created eSecurityOnline.com with the goal of becoming **the** Internet portal for corporate security professionals looking for answers to security-related questions as well as free access to security-related news, jobs, white papers, mailing lists, events, training, and products. We have developed innovative online service delivery and electronic management of security services and solutions — all of which we see as a major market direction.

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CASE STUDY: USINTERNETWORKING INC. (USi)

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Known for creating the application-service-provider field (business applications are outsourced over the Internet for a flat monthly fee), USi understands the potential power in leveraging other businesses' resources. So it made sense when the company decided to subscribe to the eSecurityOnline.com Online Vulnerability Service.

To identify and mitigate the vulnerabilities inherent in its infrastructure and software, USi opted to subscribe to eSecurityOnline.com's Online Vulnerability Service. Ty Gast, senior security analyst with USi's Information Assurance Group, says, "Now, instead of having to continuously scour multiple-vulnerability Web sites and hacker havens, eSecurityOnline offers all of these sources in a single interface, prioritizing vulnerability data and customizing it to our security architecture."

USi has found the ability to extract the results of this research and analysis in customized reports invaluable. Ron Freedman, VP of Information Assurance at USi, believes that "there's no way we could possibly duplicate the research capability that eSecurityOnline.com has." As for the difference the Online Vulnerability Service has made in USi resources, Freedman says it's "just an enormous time and resource issue that we have been able to avoid in our own staffing requirements. The savings are enormous, and so is the peace of mind."

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What has driven the need for online delivery and management of security services?

It might surprise people to learn that when Ernst & Young is hired to perform what's called "attack and penetration" work — electronically breaking into companies to test their security — more often than not, we succeed because one of three basic security steps has weakened the system: One, the company relies on default IDs and passwords; two, there are inherent software vulnerabilities; or three, the company's software and/or hardware contain misconfigurations. Because these problems are so common, clients can employ our technology, security research, and resources toward huge financial benefits for themselves. Ernst & Young makes these resources and services available through eSecurityOnline.com.

Describe these online services.

Let's take the issue of software vulnerabilities, the documentation and repair of which are the most important aspects of organizational network-risk management. Our Online Vulnerability Service addresses this. It's available through eSecurityOnline.com as a complete, customizable database of more than 2,200 known vulnerabilities and their solutions. Once an organization inputs its various assets, our service will display every known vulnerability for that configuration. This is valuable in that it lets a company run customized reports that detail its leading vulnerabilities and how to fix them — as well as its network-risk levels.

How are you addressing the other concerns of risk management?

eSecurityOnline.com also offers Minimum Baseline Standards, a service designed to assure an organization that specific system configurations — operating systems, databases, and devices — are implemented according to what are termed "best practices." For instance, there are 106 documented control standards to properly secure Windows NT out of the box. Without these standards, an organization can open itself up to unnecessary risk. The Minimum Baseline Standards program enables users to identify, evaluate, and manage the implementation of security best practices.

> "THE SAVINGS ARE ENORMOUS, AND SO IS THE PEACE OF MIND"

Aside from the online delivery model, what security consulting services does Ernst & Young offer?

Ernst & Young offers world-class ebusiness support, infrastructure, security, and IT risk-management services. An organization may decide it wants an outside party to come to their company and assess the state of its security profile. Our Security Profiling Services perform a top-to-bottom assessment of an organization's external and internal access, creating a blueprint of its vulnerabilities and giving detailed recommendations to reduce the identified security risks. Then, by developing a world-class security architecture, we address the causes of systemwide vulnerabilities, taking business, operational, and IT strategies into account. Ernst & Young offers companies the flexibility, resources, and experience they need to meet their ebusiness imperatives.

*Source: International Data Corporation

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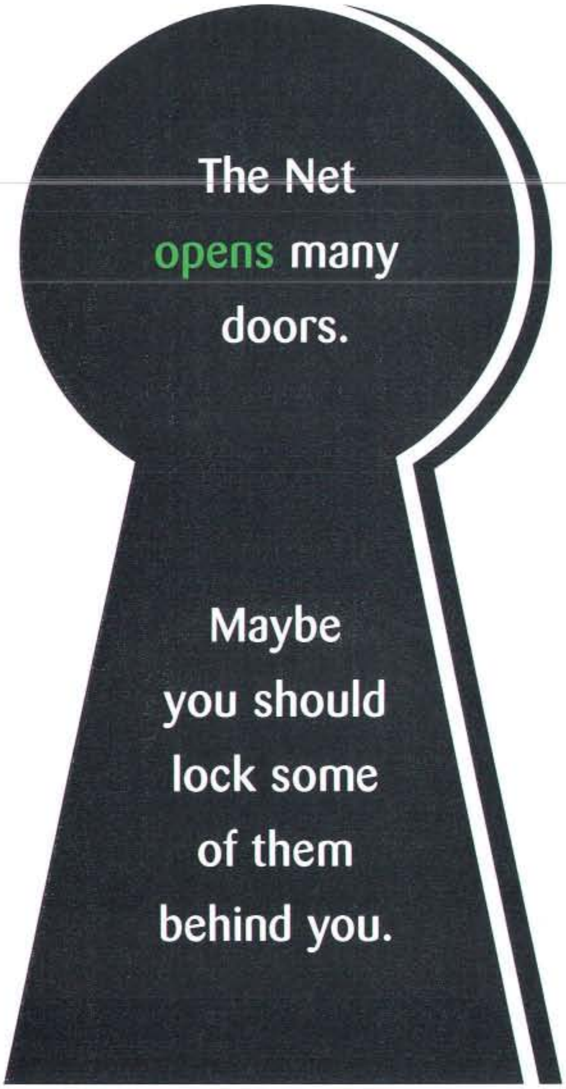

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von Gablenz hopes to head off New World negativity about inherited privilege. But, as a countryman and colleague of his explains, that title – deflated though it may be in a 21st-century democracy – is hugely relevant to von Gablenz's sense of purpose. "Don't forget von Gablenz is an aristocrat," the man says. "There is an obligation for him to be a good knight, and if you want to be king, you better strive to be the good king."

For three generations, the von Gablenzes have been knights of the sky. Carl's grandfather, Baron Carl-August von Gablenz, a pilot in World War I, became a founder of Lufthansa Airlines. Carl never knew him – the patriarch died in a 1942 plane crash. But Carl's father, Franz-Heinrich, was also a pilot; he flew reconnaissance missions over Africa in World War II, and ultimately became chief pilot of Lufthansa. What's more, one of Carl's aunts is a von Richtofen, from the family that produced the Red Baron – the German flying ace of World War I.

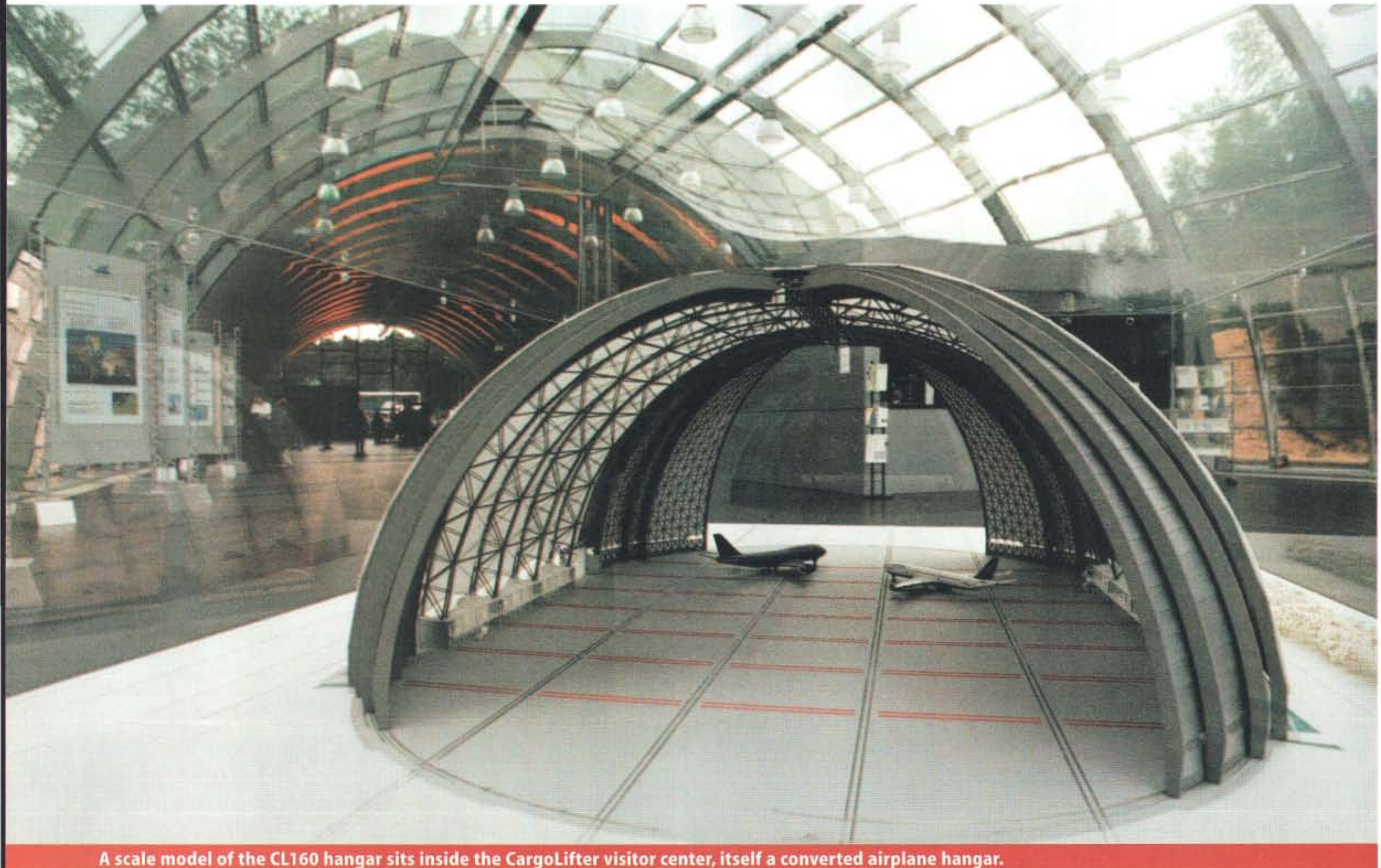
Perversely, young Carl refused to get excited about airplanes. "Flying doesn't have a specific fascination," he says. "Being able to fly, this is not a secret." He married while in law school and earned a PhD in law with honors, but went straight from graduation into finance, rising quickly to a directorship at a German bank.

When a client one day essentially told him, "Carl, you're a smart guy, but you won't know jack until you've worked in the real world," von Gablenz accepted the challenge, quit the bank, and in 1986 took a lower-rung position at the machine-tool giant MAHO AG. Naturally, he rose again, and found himself happily wallowing in a world of mega. Von Gablenz practically swoons when recalling the big machinery at MAHO. "It has a specific sound, a smell. I still like it today," he says. "It's a symbol for production, that's what I like."

In 1993, von Gablenz's four children announced that they wanted to live in America for a while. Being in the why-not vein of innovative thinkers and adventuresome rich, the family toured the US and picked Chapel Hill, North Carolina, as its ideal American city. The baron parlayed his experience doing business for MAHO in postcommunist Europe into a research fellowship at UNC's Kenan Institute of Private Enterprise, a think tank where transportation and logistics were hot topics. He decided to make them *his* topics.

His interest might have remained acade-

The **CL160**, like today's commercial blimps, will have no frame. **Engineering-wise**, it's like jumping straight from a Cessna to a Boeing 777.



A scale model of the CL160 hangar sits inside the CargoLifter visitor center, itself a converted airplane hangar.

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Principal research engineer Tim Smith, left, and head of strategic planning Gregory Gottlieb.

Drawn by the dream, CargoLifter's **high-flying** staff is pretty impressive: "We now have two-thirds of the world's **lighter-than-air experts.**"

mic, and he might have become a long-term US resident, but for another life-altering challenge – this one more of an insult, from a visiting Thai economic-development official speaking to a group of academics at the Kenan Institute. The official declared that Europe was incapable of innovation and doomed to decay, and then turned to von Gablenz and asked, "Hey, Carl, is this right?" The baron took the question as an affront to his entire continent.

"I said we would go back and show them that we are very much alive!" he says, and in 1995 he and his family returned to Germany. At that time, the East's economy had collapsed, and Germany was in the recession that followed its reunification. Engineering companies were desperate for business and looking for an edge in exporting their macroscale goods.

Von Gablenz met with a German heavy-industry group to brainstorm and explore the shipping market. "Our market study showed the transport can be slow but needs to be heavy and big and go nonstop for long distances," he says. "Based on the background of my father, I thought the solution is an aircraft. Then the problem starts; aircraft are just too small. So I started to look for a larger flying machine."

He went to the aerospace department at the University of Stuttgart – the Caltech of Germany – and met with Bernd Kroeplin, a renowned engineer specializing in the statics and dynamics of aerospace structures. "After one hour," recalls Kroeplin, "it was clear to me that for this problem, the solution would probably be an airship." He framed the heavy-lift issue as an engineering concern. "We finally selected the solution of an airship that stays in the air during unloading, at about 100 meters off the ground," says Kroeplin. He and a team of a half-dozen engineers, financial people, and shipping experts then wrote the business plan, and began to work in earnest on the technical design.

To unload 160 tons of cargo, they envisioned an onboard heavy-lift crane to lower the freight to the ground and a system that will pump in water ballast (from oceans, rivers, water towers) to compensate for offloaded weight (43,200 gallons, or about 10 tanker truckloads, for a 160-ton payload). The need for extraordinary lightness dictates CargoLifter's most striking design departure. The old zeppelins had an aluminum frame, which provided a rigid foundation and therefore strength. But the CL160, like today's much smaller commercial blimps, will have no frame. The living/working portions of the ship, including the cargo bay, will be in a keel that hugs the airship's underbelly. Everything above the keel will be essentially gas.

That an airship could be so big and not need a frame astonishes engineers who've considered the project. "It's like going from a Cessna to a Boeing 777," marvels one scientist, "with no intermediate steps."

A CargoLifter official estimates that it will take about $2.5 million worth of helium to inflate a CL160. That's about .4 percent of the total yearly world production of 4.7 billion cubic feet of helium, which is worth $600 million. The first few CL160s won't have much impact on helium prices, but 50 giant airships might. It depends on how quickly the company launches its fleet, says Dan Morgan, the director of helium for New Jersey-based BOC Gasses, the world's largest helium purveyor. "The helium industry doesn't operate with a ton of excess capacity," he explains, "and CargoLifter would represent a spike on demand in a short period of time."

"Helium is not a big market," adds Ben Reinoehl, the director of business development for Pennsylvania-based competitor Air Products and Chemicals, "but it is unique."

Sixty-three years after the *Hindenburg*, the United States still generates more than 90 percent of the world's supply. And while initially CargoLifter will tap European and African sources for its lift-gas needs, eventually the company will have to turn to the US. "BOC hopes to become CargoLifter's main supplier," says Morgan – as does Air Products. "They're a glamour account, a huge client." A fleet of 50 CL160s would consume a full fifth of the world's

→

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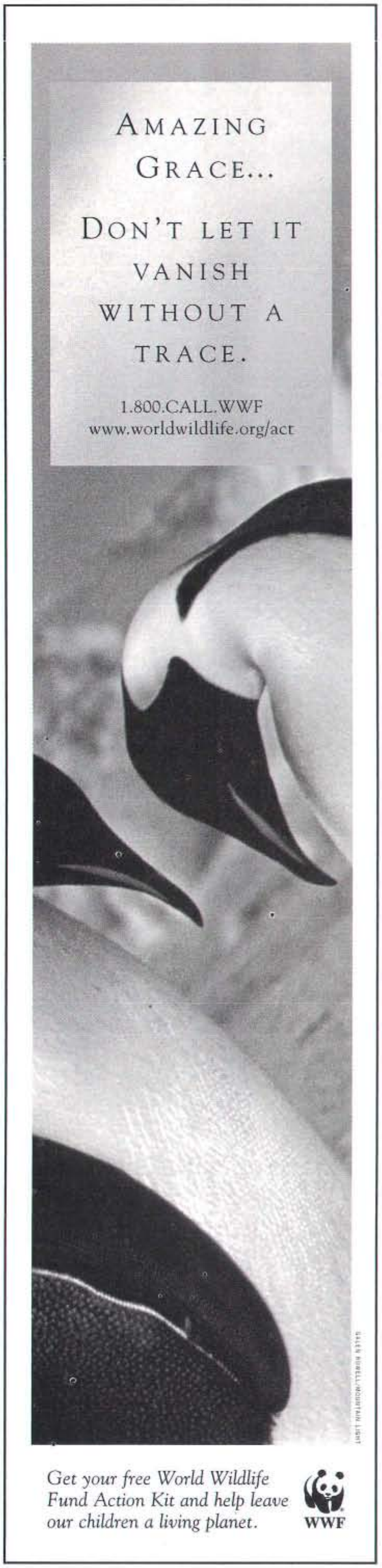

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A HELIUM SHORTAGE?

There are two kinds of stable helium. You know the first one: It puts lift in birthday balloons, Thanksgiving Day parades, the Goodyear blimp.

The other kind, an isotope called helium-3, may not be as familiar. It's a naturally occurring, but very rare, variant of helium that is missing a neutron. Helium-3 is the fuel for a form of nuclear fusion that, in theory, could provide us with a clean, virtually infinite power source.

Gerald Kulcinski, director of the University of Wisconsin's Fusion Technology Institute, is already halfway there. Kulcinski is in charge of an "inertial electrostatic confinement device," an experimental low-power reactor that has successfully performed continuous deuterium-helium-3 fusion – a process that produces less waste than the standard deuterium-tritium fusion reaction.

The next step, pure helium-3 fusion (3He-3He) is a long way off, but it's worth the effort, says Kulcinski. "You'd have a little residual radioactivity when the reactor was running, but none when you turned it off. It would be a nuclear power source without the nuclear waste."

If we ever achieve it, helium-3 fusion will be the premier rocket fuel for centuries to come. The same lightness that floats CargoLifter's CL160 will allow helium to provide more power per unit of mass than anything else available. With it, rockets "could get to Mars in a weekend, instead of seven or eight months," says Marshall Savage, an amateur futurist and the author of *The Millennial Project: Colonizing the Galaxy in Eight Easy Steps*.

The problem? We may run out of helium – and therefore helium-3 – before the fusion technology is even developed.

Nearly all of the world's helium supply is found within a 250-mile radius of Amarillo, Texas (the Helium Capital of the World). A byproduct of billions of years of decay, helium is distilled from natural gas that has accumulated in the presence of radioactive uranium and thorium deposits. If it's not extracted during the natural gas refining process, helium simply soars off when the gas is burned, unrecoverable.

The federal government first identified helium as a strategic resource in the 1920s; in 1960 Uncle Sam began socking it away in earnest. Thirty-two billion cubic feet of the gas are bunkered underground in Cliffside, a field of porous rock near Amarillo. But now the government is getting out of the helium business, and it's selling the stockpile to all comers.

Industrial buyers use the gas primarily for arc welding (helium creates an inert atmosphere around the flame) and leak detection (hydrogen has a smaller atom, but it usually forms a diatomic molecule, H_2). NASA uses it to pressurize space shuttle fuel tanks: The Kennedy Space Center alone uses more than 75 million cubic feet annually. Liquid helium, which has the lowest melting point of any element (–452 degrees Fahrenheit), cools infrared detectors, nuclear reactors, wind tunnels, and the superconductive magnets in MRI equipment. At our current rate of consumption, Cliffside will likely be empty in 10 to 25 years, and the Earth will be virtually helium-free by the end of the 21st century.

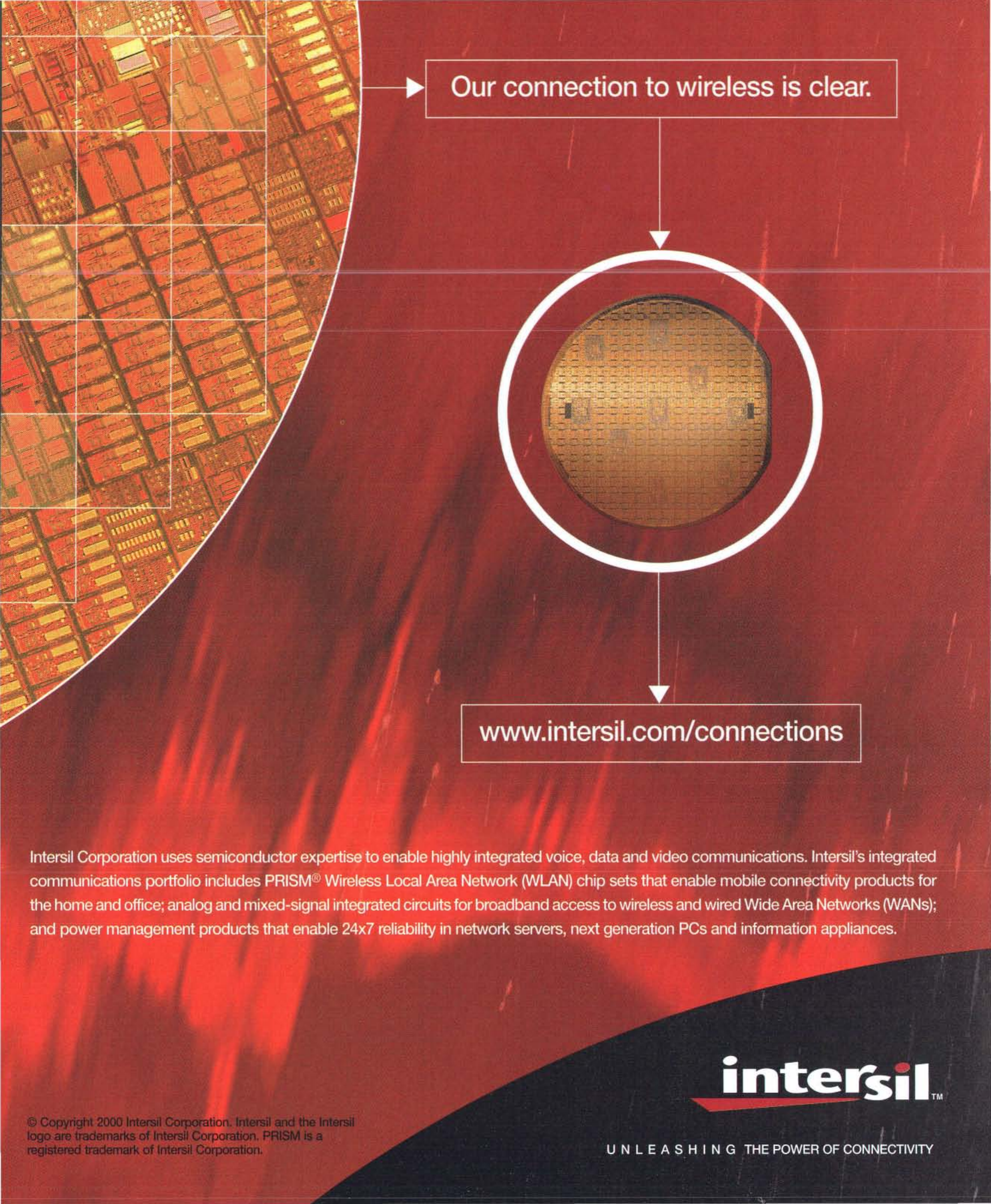
"For the scientific community, that's a tragedy," says Dave Cornelius, a Department of Interior chemist at Cliffside. "It would be a shame to squander it," agrees Kulcinski.

For helium-3's true believers – the ones who think the isotope's fusion power will take us to the edge of our solar system and beyond – talk of the coming shortage is overblown: There's a huge, untapped supply right in our own backyard.

"The moon is the El Dorado of helium-3," says Savage, and he's right: Every star, including our sun, emits helium constantly. Implanted in the lunar soil by the solar wind, the all-important gas can be found on the moon by the bucketful.

Associate professor Tim Swindle and his colleagues at the Lunar and Planetary Laboratory at the University of Arizona have already begun prospecting. Swindle has mapped likely helium-3 deposits on the moon by charting the parts of the lunar landscape most exposed to solar wind against the locations of mineral deposits that best trap the element.

But, says Swindle, when we really want a lot – when we're rocketing to the Red Planet and back for Labor Day weekend – the best place to gas up won't be the moon: "The really big source of it is *way* out." In our quest for helium-3, we'll travel to Uranus and Neptune, whose helium-rich atmospheres are very similar in chemical composition to the sun's. If futurists like Swindle and Savage are right, the gas will be our reason for traveling to our solar system's farthest reaches – and our means of getting there. – *Emily Jenkins*



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→ current annual helium production. And keeping things ever interesting for the folks at CargoLifter is this unavoidable fact: The helium supply, some scientists say, is running out. (See "A Helium Shortage?" page 162.)

CargoLifter officials are not worried, however. "Exploration for new sources of helium is expanding, and new technologies are making existing helium use more efficient," says Tom Boyle, CargoLifter's VP of marketing and logistics. "More important, developing technologies are allowing larger amounts of helium to be extracted from natural gas." Morgan has also reviewed the situation and feels hopeful. "It's like the oil industry in the '70s, when everyone was forecasting that we were going to run out of oil by the '90s," he says. "A helium shortage is a concern, but am I losing any sleep over it? No."

What you can see at the CargoLifter Homeport is both tantalizing and dubious: Can they or can't they?

The *can* side of the question makes a mighty architectural statement. Rising above the Brand campus is the company's airship construction hangar, due to be finished this fall. It's a curving steel-ribbed potato bug, 1,180 feet long, 350 feet high, 690 feet wide. The $77 million hangar, 50 percent subsidized by the Brandenburg state government, is an emblem of the enthusiasm and hope that Germany has tied up in the baron's big balloon.

The staff is pretty impressive, too. Gregory Gottlieb, a former major in the British army and an airship expert initially charged with scouting the globe for engineers and managers to join CargoLifter, says, "We now have two-thirds of the world's lighter-than-air experts." In all, 240 people from 15 nations are employed by CargoLifter in Germany and America.

Ask around and you quickly start hearing inspired-by-the-dream tales. Tim Smith, the American engineer who came to CargoLifter from Syntek, a Washington, DC-based marine and aerospace consulting firm, says he flipped for the baron's project at a presentation in the US, during which von Gablenz playfully winged a chalkboard eraser at a colleague who was dissing the airship idea. German documentary filmmaker Dirk

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Pohlmann once did a video report on CargoLifter for a TV producer, who looked at it and said the operation was a joke. Pohlmann argued that the project was worth a story, quit over it, and subsequently got hired as CargoLifter's in-house documentarian.

Giles Camplin, a history buff who has devoted his professional life to what he calls "weird and wonderful lighter-than-air craft," came to CargoLifter in 1998 from his home in the UK. He spends his days going through all the German, US, and British archival records CargoLifter has acquired. Von Gablenz, despite his "no technology is old" mantra, is equally mindful that mistakes can be avoided by studying those made by predecessors. So he hired Camplin to unearth any historical airship facts that will aid the project. Camplin says, "We are not particularly interested in how to stick cows' intestines together to make airbags." But on the other hand, "some things remain constant," such as the need for a meter-wide pressure-release valve sensitive to gradients of 1/10 of a pound per square inch. Nothing like it has been made since the zeppelins, but it still exists on paper. "That valve that worked in the 1930s will pretty well work today," Camplin says.

To lead the multinational effort to design and build the CL160, von Gablenz turned to an American. Frank Bruno was happily retired from the aviation contractor Pratt & Whitney, where he'd been a highly respected general manager and chief operating officer of turbo power and marine systems. "Three or four guys I worked with at Pratt said, 'This thing can't work.' But they couldn't tell you why," Bruno says.

I meet him in his corner office on the Brand campus, where we're joined by Glenn Beach, a younger American in a power suit, who is a senior adviser and head of design review. Beach came to CargoLifter from TCOM, a Washington, DC, maker of tethered radar and defense blimps. The point of the meeting is to acquaint me with what the two men say is the one advance that absolutely *has* to occur for a nonrigid ship as big as a CL160 to exist.

The advance lies on a round table in front of us, a 1-foot-square swatch of material that resembles a stiffer, more slippery version of the rubberized fabric in inflatable rafts. It's white on one side, black on the

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other, and 1/16 of an inch thick. At 28 ounces a square yard, it isn't especially heavy. But a CL160 will require some 60 tons of the stuff, which will serve as the skin of the balloon – the "envelope," they call it – that holds the CL160 aloft, providing its shape and rigidity, and bearing its weight. "The fact is, 10 years ago, the materials did not exist to produce the type of airship that we're currently designing," Beach says. The two-layer laminate with embedded fibers is a proprietary material, the product of numerous trade secrets, but Beach is willing to divulge a few basics. "The key to our strength is the use of LCP [liquid crystal polymer] fibers," he explains. Polymer chemistry has been used in blimp envelopes for 20 years, but recent advances in the tear strength of the CL160's new LCP fabric are such that a 1-inch-wide ribbon can support a ton. Because of this fabric, the CL160 can support itself – no frame needed.

Some 90 percent of the airship's other components are pretty much off the rack or are customizable from current sources. "The gas turbines are used on helicopters. The avionic controls are state-of-the-art stuff that already exists," says Bruno. "With a lot of the engineering and design work we're doing, it doesn't matter if it's an airship or the Airbus A3XX. The fuel systems, the hydraulics, the aviation, the propulsion, all these things. Once you get past the idea that the lifting body is not a wing but an envelope of helium, all the systems are very similar to jumbo jets."

He shows me the chain of command for the CL160's design process: one committee topped by another committee topped by a controlling change-review board, on which both he and von Gablenz sit. The pyramid structure is typical of massive aerospace projects, Bruno adds, except that his group has to move a lot faster.

"If you go to Boeing or Airbus, it takes them years to go through this process. We don't have years," he says, giving me an example of the kind of conflict that can arise during design discussions. He says the group charged with the CL160's maintenance issues wanted some sort of landing gear so the airship could sit on the ground while the crew swaps out engines and does other routine mechanical work. A reasonable request, says Bruno: "It's kind of a pain

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in the ass to do maintenance on something that's 70 meters off the ground." On the other hand, "Look at the undercarriage of a 747. Now scale it up to a 500-ton airship. We have two choices: We can either have landing gear or cargo."

The maintenance team lost the landing gear argument, because the big picture – carrying heavy cargo – dwarfs all other concerns. "That's why we call it CargoLifter," Bruno says in a practiced singsong, like he's said it a hundred times before. "Its purpose in life is so we can lift things."

Having decided how to build it, they now have to figure out how to fly it. While I'm in Brand, CargoLifter receives its first green light from the Luftfahrt Bundtsamt, or LBA, the German equivalent of the FAA. It's the same process any new aircraft must go through before it gets approval to fly. "We were certified by the LBA to design an airship," Bruno explains, adding that he expects CargoLifter to be approved by the LBA as an airship maker later this year. Its first CL160 will be certified as an experimental craft for flight testing; then it will get a "type certificate," meaning "we can make these things and go fly them. We'll deal with the LBA, and the FAA will basically accept the LBA's decision," Bruno says.

Ronald W. Allendorfer, the FAA official who has met with CargoLifter, confirms Bruno's assessment of the process. "In principle, we would accept their certification," says Allendorfer, supervisor of flight standards at the agency. Next, CargoLifter officials will meet with the FAA's international office. While Allendorfer says that the CL160 could conceivably fly into Manhattan or Chicago, subject to air traffic control like any other dirigible, he stresses that certification always comes down to "flightworthiness … how it handles."

Mats Bäcklin is pondering the same question. "We're leaving aviation standards, going toward naval standards," the CargoLifter pilot says. The Swedish-born Bäcklin trained to be an engineer but then became a blimp pilot in 1992, cruising the skies under the colors of Blockbuster, Russell Stover, the Family Channel. So far, Bäcklin's flying for CargoLifter has involved test hops in a single-passenger mini-CL160 named *Joey* (as in a baby kangaroo), 100 feet long and cute as can be. *Joey* was built by the CargoLifter engineers mostly for company morale and PR reasons. Bäcklin explains that the mini-airship is much too small to demonstrate airship behavior and that it's really a model for testing design software, "a calibration tool for computer models" that allows programs to be reality-checked.

While he waits for the real thing to become flightworthy, Bäcklin, along with others in the company, is studying crew composition and accommodations. The current estimate of crew size is 10 to 12 people, not including the men and women they'll need to employ for the launch and capture phases. (Camplin notes that it's not economically feasible these days to do what the Zeppelin Company did: hire hundreds of ground crew members to hold on to tether ropes and walk the arriving or departing airship like a megadachshund.) Says Bäcklin, "We'll need a minimum, depending on the complexity of the system, of a pilot and some type of commander. For high workload phases, launch, and capture, we'll need two pilots and a commander."

All prior heavy-lift projects have failed. "This will have a life of its own," says a CargoLifter engineer, "so much is at stake politically and nationally."

Bäcklin says the ship will require onboard mechanics, "because we're going to want to do maintenance during flight." Crews might even have to swap out engines midflight.

"Typically," says Bäcklin, "we're looking at a crew stay of 10 days maximum on the ship. It's not going to be glamorous at all." And yet he says it with a dreamy quality in his voice. He even mentions a commercial blimp pilot he knows who said it's impossible to get tired of looking out the window. "You fly low and you fly slow. It's a human pace of moving. If you're flying on the west coast of America, you see whales, seals, otters. You see life."

Later this year, Bäcklin will have something big to fly when CargoLifter takes possession of a new Skyship 600 B. The kind of 200-foot blimp that's familiar to stadium crowds, the 600 B will be used by the company for pilot training and certification.

Yet even the 600 B won't be able to duplicate the "feel of the inertia" of the mothership, Bäcklin notes. The volume and mass of the CL160 will take it into the realm of what Tim Smith calls "crazy physics." His business card bears the title Flight Science/Performance Stability & Control Coordinator, and at CargoLifter, he has functioned as a sort of psychotherapist for the CL160, trying to create coping mechanisms for the crazy physics and other neuroses of his giant flying client. He does underwater performance tests with a model airship, because an object as big as the CL160 would move through the air much as a submarine moves beneath the sea. He is also looking into using cryogenic wind tunnels for further simulations. The air in these tunnels is ultracold and dense – mirroring conditions that are more like water than air.

Smith's latest problem involves the physical properties of helium. "When you compress a gas, which is what happens when an airship descends, the volume gets smaller and the gas gets hotter," Smith says. And heated gas rises. So, just as an airship achieves downward thrust, the heated helium gas nudges the vessel to rise again. A 1-degree Celsius temperature change adds or subtracts 2 tons of lift. Even normal moment-to-moment temperature shifts will affect the airship. "Go behind a cloud, you lose 5 tons of lift. Come out, you gain 5 tons," Smith explains. Level cruising will have to be fought for. "We'll need tons of lift aerodynamically to wrestle this helium monster."

"We're so big we really need to boost the aerodynamics," he adds. A move that would have made a zeppelin ascend – putting the flaps up on the horizontal rear stabilizer – is likely to make the CL160 descend. "It's so large, it's like herding elephants," says Smith. "You have to coax it to do things." Smith helped develop a "power wing" system, the likes of which airships have never had. The CL160 will get both forward thrust and corrective doses of up-and-down impe-

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tus from two wings that contain horizontal, gas turbine-powered propellers, for vertical liftoff and down thrust, as well as props in an airplane-style position, to push the ship along. The wings, coming out from either side of the keel, look stubby in renderings Smith shows me, but he says they're bigger than a 747's wings, and will be thick enough for mechanics to stand upright inside them and do engine work.

"This isn't the strangest project I've done, but it certainly is cool," Smith says, although he emphasizes that "cool" alone would not have brought him here. "I was tired of working on projects where, for all the wrong reasons, it's just the wrong time for this idea," he says. "This," he adds, "is the right time."

Cool. Yet I have to wonder about the baron's messianic message and the road-to-Damascus stories of the happy employees, the adorable *Joey* and the crazy physics, the idea of CL160 as a drive-in movie theater, and I ask myself: *Is* it the right time? Do these people actually know what they're doing? I can tell they're having a gas at work, and I'm guessing that many of them spent their careers in stultifying corporate environments until von Gablenz swept them up into his heavy-lift dream. But there's a vague Willy Wonka feel to the Homeport, as if a bunch of precocious kids were on an adventure that could easily veer into disaster.

After all, every heavy-lift project before CargoLifter saw its funding dry up while it was still just a bright idea. Only five years ago, this very thing happened with an American project. It wasn't a CargoLifter-style airship but a "flying wing" – an aerodynamically shaped aircraft lifted in part by helium. It was a joint venture between FedEx and Lockheed-Martin's famous Skunk Works lab (now officially called Lockheed-Martin Aeronautics Company). A FedEx spokesperson will say only that the company judged the flying wing to be cost-ineffective. Skunk Works communications director Gary Grigg is slightly more revelatory. "It's one thing to do an initial conceptual design, it's another thing to get into detailed design and convince yourself that it's doable," Grigg says, referring to the whole field of out-of-the-box airfreighters. "We just think there's a lot more work to be done before such a →

GARGANSPORTATION

Small is beautiful in high tech, but progress isn't always measured by shrinkage alone. While we eagerly await the Library-of-Congress-in-a-Timex, an equal but opposite macromovement is afoot in the load-hauling industry. It's not just blimps, but trucks, ships, and planes, too. The gigantic results are borne of an ambitious philosophy that might almost seem passé these days: Bigger is better.

"There's definitely a market for larger and larger machines," says Kenneth Boyer, an economics professor at Michigan State University and the author of *Principles of Transportation Economics*. "The bigger the vehicle, the cheaper each unit of cargo is to move." And the "cargo" can be anything from coal to sunburned vacationers.

Although creating XXXL conveyances requires advanced construction techniques, the real challenge is in the design: This new wave of giant contraptions rumbling to life must still function within the confines of the existing infrastructure. It's not always just a matter of scaling up.

CATERPILLAR 797

As massive as an eight-bedroom, two-story home, Caterpillar's 797 went on sale this year as the world's largest mining truck: its 48- by 30-foot pickup bed can handle a 360-ton payload. The Peoria, Illinois-based company built the $3.2 million leviathan to carry ore and oil sands (petroleum is extracted from the grit) over steep and potholed strip-mine terrain. It has 24 cylinders under the hood and almost 50 percent more hauling capacity than last year's biggest truck. More important, the 797 has a computer-designed steel frame that's cast, not fabricated: Only a few welds are needed to piece it together. The result is a half-million-pound Tonka that's far stronger but tons lighter than if it had been built using traditional methods – so it can carry more.

For maximum efficiency, mining-truck volume must be a multiple of mining-shovel capacity. Cat built the 797 specifically to handle the 90-ton loads carried by the industry's biggest shovels; four scoops and the truck is full. But P&H Mining Equipment of Milwaukee recently debuted a "dipper" capable of snatching ore in 100-ton bites, which creates a problem in filling the 360-ton-capacity pickup. "Now it's one-two-three full scoops and then what?" asks Bristol Voss, the North American editor for *World Mining Equipment* magazine. A fourth full scoop would overfill the truck. What to do with the last 40 tons? "You don't want to spill the stuff."

While Cat staffers put their hard hats together over ways to expand their suddenly undersized pickup, the competition, Liebherr Mining Equipment, is using the opportunity to start a hauling-space race. This fall, the Swiss company will introduce a mining truck with a 400-ton payload – and even bigger versions are in the works.

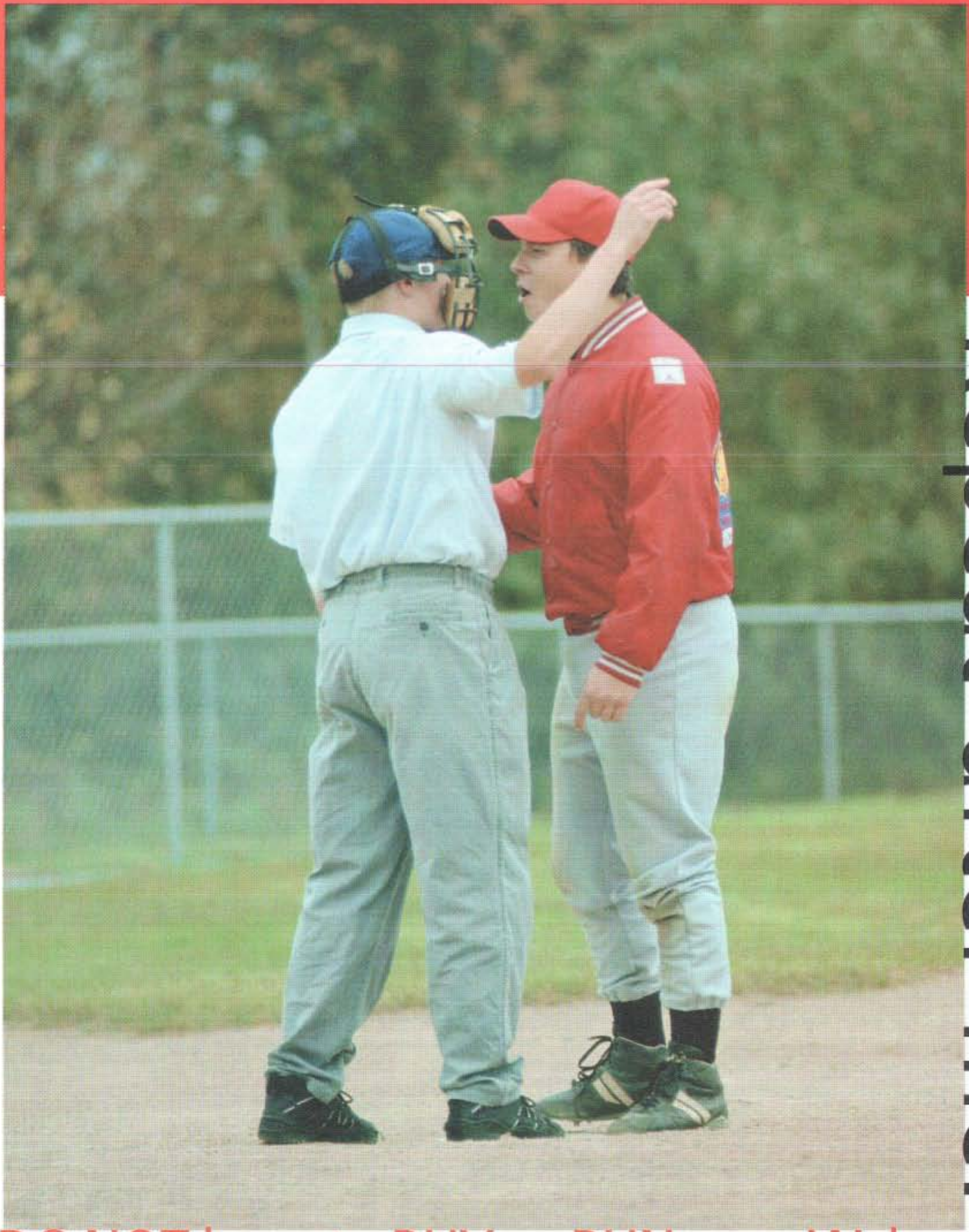
CUNARD *QUEEN MARY 2*

Due for christening in late 2003, Cunard Line Limited's *Queen Mary 2* will be the Goliath of floating shuffleboard platforms. Twenty-one stories high and 1,130 feet long, the cruise ship stretches out like the Empire State Building set on its ear.

There are larger ships on the ocean and on drawing boards – a 1,513-foot-long supertanker, the *Jahre Viking*, built in 1979, currently holds the record for sheer size, and there are dubious plans afoot for a $9 billion fantasy barge called the Freedom Ship, which would permanently house some 40,000 people. But the *QM2* will reign as the world's largest cruise ship.

In some ways, the $700 million vessel is a throwback. The *QM2* will offer the retrograndiose *Titanic* experience: *Mary* will wear the traditional steamer colors of federal gray, white, and red, and feature butler service and a chandeliered ballroom with a 30-foot ceiling. But with a computerized navigation system that employs GPS technology and two omnidirectional propellers, icebergs won't be a problem.

The Panama Canal, however, will be. For decades, cruise ships were built so that they could fit through the canal's 106-foot-wide canal locks. Most cruise ships winter in the Caribbean and then travel the Panamanian shortcut to Alaska during the summer months. *Mary*'s different: Her beam is 131 feet wide, so the canal is off limits. No problem, though. She has the muscle →



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→ system comes to fruition. That's why we're not there." His skepticism extends to the business side, too. "There have been a lot of abandoned projects. Maybe the market hasn't been defined," he adds.

A few engineers with CargoLifter connections express similar reservations about the CL160, all conveying variations on the same theme – that success by 2002 with a project of such enormous scale is nearly impossible. One source says that "the engineers are falling behind what the marketing people are promising," but they keep their chins up because "there's so much enthusiasm for them to keep to the script" of launching in two years. One former employee says von Gablenz has fostered naive expectations and a rah-rah company culture that makes CargoLifter especially vulnerable to bugs: "It's a success-oriented program, and as such, they're not looking for the problems."

None of these people, however, say that the company is bound for the airship slag heap. "This will have a life of its own," says one engineer, "because there's so much at stake, politically and nationally."

Or, as Frank Bruno says, "The only things between us and that airship are the calendar and dollars."

It's hard to argue with a promise. Nor can you know how much you need something if you've never had it. David Henley, director of business development for Parsons Transportation Group in New York City, says he believes the global market will find good use for CargoLifter's freighters. "I'm glad somebody is doing it," says Henley, whose company hopes to work with CargoLifter.

Last year, his firm was involved in the replacement of the 100-year-old subway tracks on New York's Williamsburg Bridge. Some of the parts were quite big, so they had to be broken down and trucked to the bridge in the wee hours to avoid snarling the heavy traffic in Manhattan and Brooklyn. The parts could have been delivered whole and more conveniently had they been floated directly from the manufacturer to the bridge via airship, says Henley. "When you start thinking about how such a tool could be used, the possibilities are endless."

Transportation's last revolution, he notes, was about 40 years ago: the adoption of a globally uniform system of freight containers (they now come in only two sizes). "I don't know if CargoLifter is the precursor to a major paradigm shift in logistics … or if it's going to meaningfully change anything," Henley says, choosing his words carefully. "But it will play a part."

An American daydreams about using an airship to fix a bridge. A German daydreams about using an airship to fix the human spirit. Why not? Maybe that kind of belief, along with enhanced technology and a healthy budget, will make the difference between von Gablenz's success and failure. Bernd Kroeplin, the aerospace-engineering expert who told von Gablenz that what he needed was an airship, paints a picture of the CL160 as a world healer. "If people see airships flying, they feel they are never scared, like a kind of fish in the air," he says. "There's a connection to the internal feelings of friendship. People feel there's a solution *for* them, not against them."

One day, I receive an email from a CargoLifter employee, a German, who apparently has just come from a meeting with von Gablenz and is freshly revved. He is trying to get me to abandon my inbred American skepticism, to see what he and the baron see. "No one will forget the shiver of human pride and dreamlike phantasy when he sees the big ship float through the sky for the first time," he writes. "It will be technological art. Skywhales doing good business. Cargonauts will have to be like the mariners of the sailing age. Craftsmen of the atmosphere. Don't talk much. Travel slow. Drop chocolate for children. Know a lot. Teach navigation to youngsters in Central Africa. Make everybody dream to become part of it. Be able to knit 42 types of knots and software programs. Leave a track of soft, floating energy." This airship poet acknowledges that he's writing across a huge cultural divide: "It's different here."

Indeed, it is. To the people who will it aloft, the baron's big balloon won't just fly, it will live – a "big sort of flying animal," as von Gablenz puts it, a little less rhapsodically than his employee, but with feeling. "You pull the *Hindenburg* factor out of their brain. And that old dream of getting something big in the air comes back." ■ ■ ■

Mike Steere (yoyobop@earthlink.net) *writes for* Outside, Worth, *and other magazines.*

→ to get to Alaska the old-fashioned way – around Cape Horn. The inch-thick steel on her hull, twice as beefy as smaller cruise ships, is specially designed for the voyage.

Although there's romance to be found in Magellan's wake, *QM2*'s celebrated bulk does present the very mundane hurdle of finding a parking spot. "She'll almost always overhang the end of her berth. Mooring decks will have to be rearranged so that we can tie up the ship," admits Gerry Ellis, who coordinated the *QM2* project for Cunard. "We had to convince Sydney to take her."

AIRBUS A3XX-200

Worldwide air travel is predicted to triple in the next 20 years, and Paris-based Airbus Industrie wants to produce a skybound auditorium to handle the load. The A3XX-200 will be able to hold nearly 656 passengers, compared to the Boeing 747's measly 416. The plane will be the club sandwich of the airways: a triple-decker. The top and middle floors will each have a wide-body's worth of seats, but the "basement" will be built to standing-room dimensions. "On a transatlantic or intercontinental flight, passengers get bored with movies," says Airbus spokesperson Mary Anne Greczyn. "Now the airlines have an option to put in something like a shopping mall or a fitness center."

Even without the barbells, the 1.3-million-pound A3XX-200 will outweigh the 747 by 50 percent. However, the 260-foot plane will be only 10 percent longer – most of the added weight is due to the three-story fuselage, which will make the A3XX-200 look like an obese 747. Anything bigger would bump up against international restrictions and require runways to be reconfigured. (The biggest plane ever to fly is technically Howard Hughes' flying boat, the *Spruce Goose*. It weighed only 400,000 pounds but had a wingspan of 320 feet. It flew once in 1947, for less than a minute.)

The $250 million A3XX-200 will likely be aloft by 2010, but the real obstacle to its use is on the tarmac. Concerns have been raised over how long it might take a prison-size mob to board and deplane the monstrous aircraft. Several Asian and European airports are already exploring the idea of installing double-decker access. "The last thing anyone wants," says Barbara Beyer, president of Avmark, an aviation consulting firm in Arlington, Virginia, "is for an eight-hour flight to go on for ten." *– Andrew Tilin*

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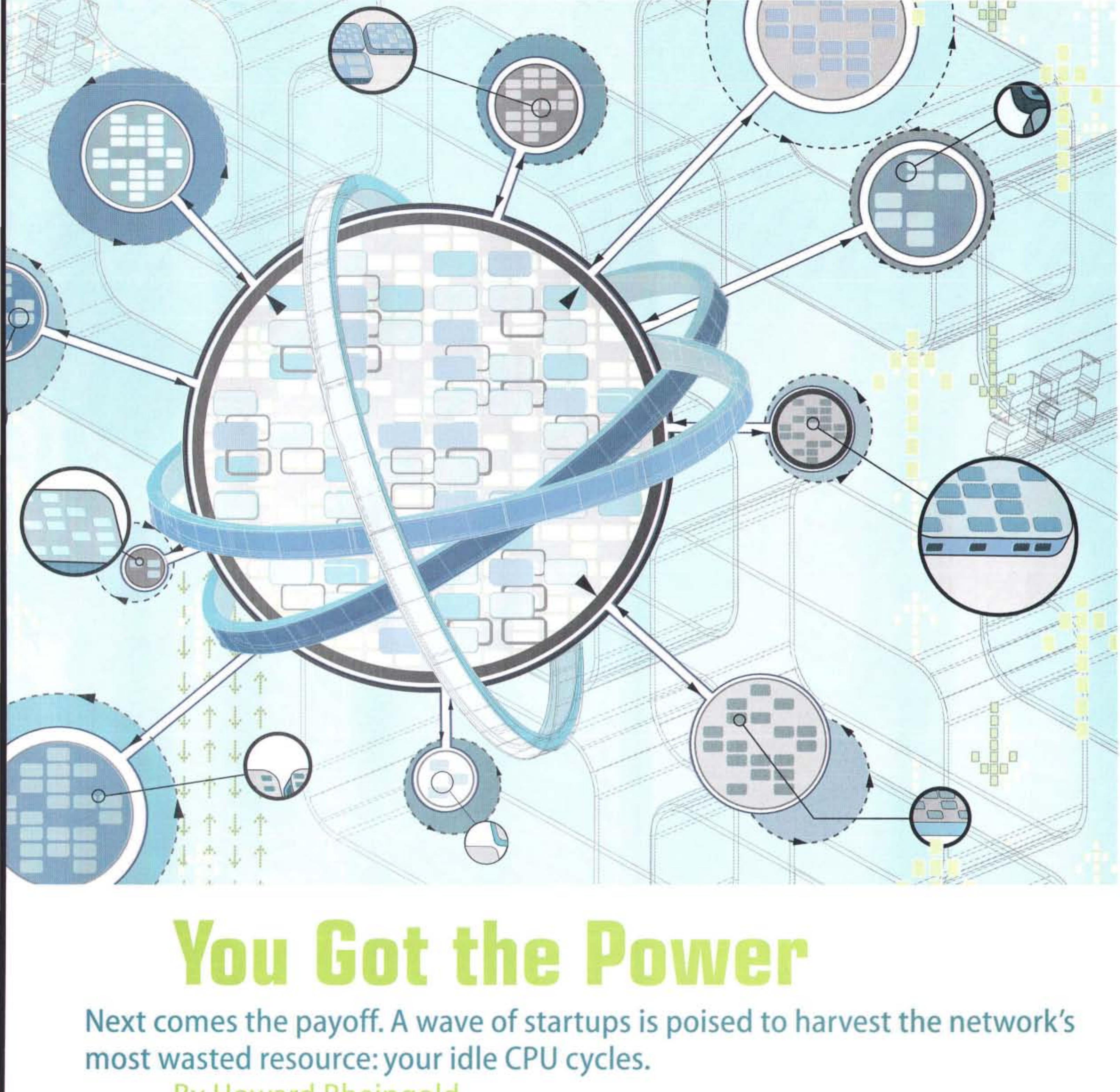

You Got the Power

Next comes the payoff. A wave of startups is poised to harvest the network's most wasted resource: your idle CPU cycles.

By Howard Rheingold

Nelson Minar isn't afraid to think big. The CTO of San Francisco-based Popular Power has a dream of linking millions of otherwise idle PCs worldwide to perform monumental computations, building a supercomputer out of unemployed resources.

Minar's global vision has humble beginnings. Popular Power's spartan headquarters feature a few thrift-store rugs and secondhand desks, a wall map of the Internet, and a couple of computers. There's no conference table and not even enough chairs, so Minar stands and delivers his spiel.

"The Internet is lifeless if the only thing we do with it is display Web pages," says Minar, a former MIT Media Lab researcher. "That's what we're after - bringing the Internet to life." When Minar says "we," he's actually referring to millions of folks whom he hopes will voluntarily lend him the use of their computers.

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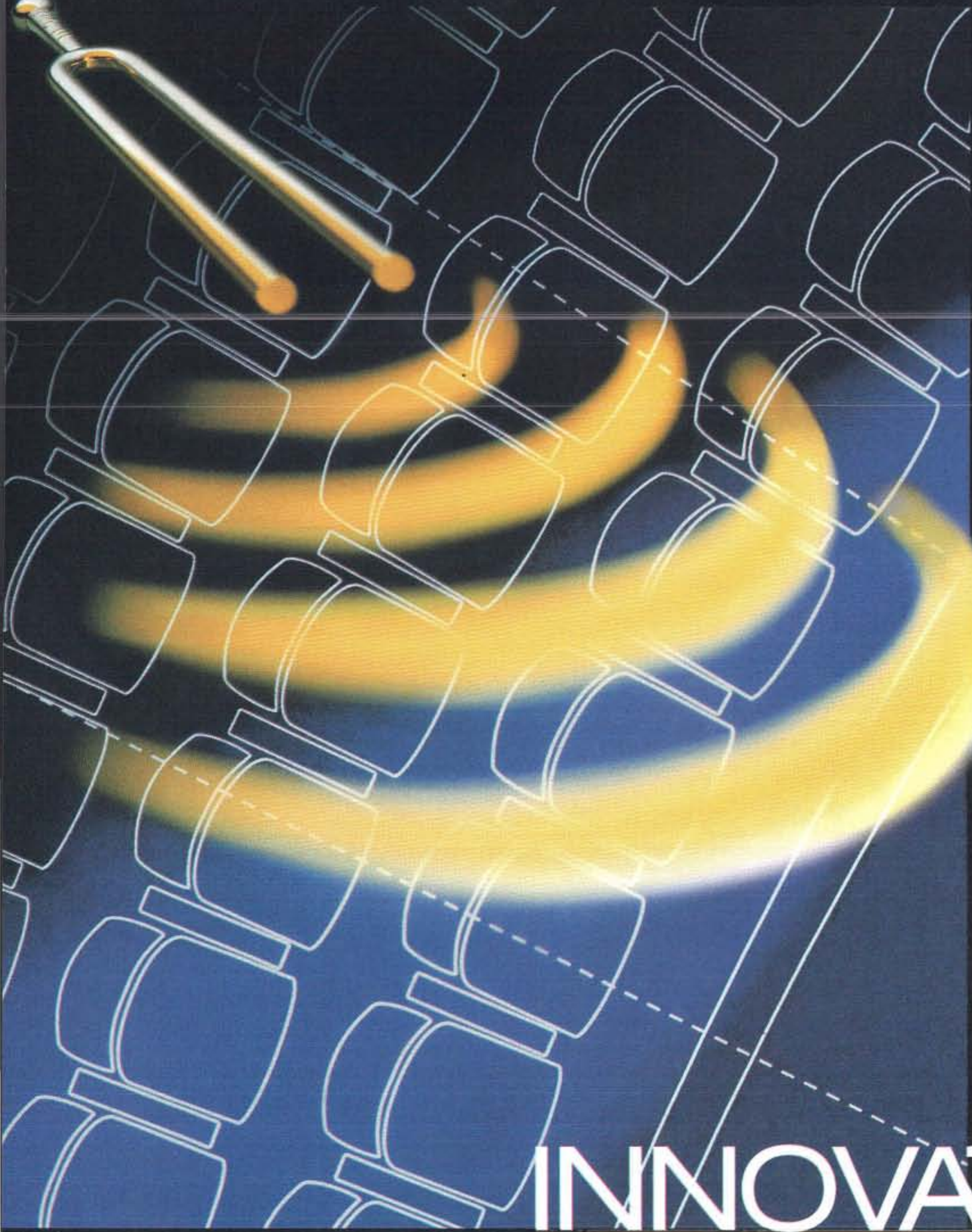

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In January, Minar and his onetime Reed College classmate Marc Hedlund founded Popular Power (*www.popularpower.com*), the first commercial distributed computation company to release software allowing any participating business to do work on its platform. To Minar & Co., community computation isn't just a budding business. It's a cause.

At its most basic level, distributed processing is a way of harvesting a resource that until now has been squandered on a massive scale: unused CPU cycles. Even if you type two characters per second on your keyboard, you're using only a fraction of your machine's power. During that second, most desktop computers can simultaneously perform hundreds of millions of additional operations. Time-sharing computers of the 1960s exploited this ability, allowing hundreds of people to use the same mainframe. More recently, millions of PCs around the world have been banded together on the Net to create, with their downtime, ad hoc supercomputers.

Bioengineers, mathematicians, and cryptographers already take community computation seriously. Big business may be next.

These multi-teraflop CPU communities, harnessing trillions of floating-point operations per second, have joined forces most famously for the SETI@home project, which unites the computing power of millions of PCs around the globe to search for signs of extraterrestrial intelligence.

But community computation is also at work in less celebrated arenas, providing the muscle to analyze protein-folding problems in bioengineering, large prime numbers in cryptography, and planetary climate models. Others see distributed processing aiding in the design of synthetic drugs, an effort that requires trial simulations on billions of possible molecules.

And big business may be next. Several startups are experimenting with ways to link idle computers cheaply, selling off the resources to the highest bidder. Community computation came into existence because enough people thought it would be a cool thing to do. Distributed processing's second wave could lead not only to new industries, but also to new ways of thinking about computation.

You know you've made it to the front door of SETI@home when you come across the WELCOME ALL SPECIES doormat. It's here, at the University of California Space Sciences Laboratory in the Berkeley hills, where you'll find the mothership of community computation, the largest cooperative computing effort in the world.

More than 2 million computers worldwide participate in SETI@home, donating untapped CPU time to analyze signals collected by a radio telescope in Puerto Rico. The telescope pulls down about 50 Gbytes of data per day, far more than SETI's servers can analyze. That's where community computing comes in. SETI@home participants install client software that analyzes a tiny portion of the signal, while functioning like a screensaver. The software downloads a small segment of radio telescope signals and processes it, looking for interesting patterns consistent with intelligent life. When the task is complete, the program uploads the results to SETI@home headquarters and collects a new chunk of digitized space signal to search.

SETI@home's global network of PCs can perform 12 teraflops, easily beating today's fastest supercomputers, which top out at about 3 teraflops. David P. Anderson, SETI@home's director, shows me the rack that houses the project's three servers, nicknamed Sagan, Asimov, and Cyclops.

"Sagan sends out the work units," Anderson explains, pointing to one of the Sun Enterprise 450 servers. "Cyclops and Asimov both run database servers. When the client program gets one of these batches of radio telescope data and spends however many hours analyzing digital patterns, it sends back a shortlist of interesting things it found. Those are pattern matches, a shape of the noise that is similar to what we're looking for. Each of these interesting finds is entered into the database. We have already accumulated about a half-billion of these candidate signals."

The idea for SETI@home arose in 1995, when Anderson was contacted by a former Berkeley grad student named David Gedye, who'd become the CTO of Apex Learning. Inspired by documentaries about the Apollo space program, which made people all over the world feel that human beings were taking a collective step forward, Gedye wondered whether a project today could have a similar impact. He hit upon the idea of harnessing the public's fascination with both the Internet and the SETI program to form SETI@home.

It took nearly three years to raise enough money to develop the software, and in mid-1999, Unix, Windows, and Macintosh versions of the SETI@home client were released within a month of one another. "It's been a wild ride since then," says Anderson. "We were hoping for at least 100,000 people worldwide to get enough computer power to make the thing worthwhile. After a week, we had 200,000 participants, after four or five months it broke through a million, and now it's past 2 million."

SETI@home is community computation's first true success story, having already racked up the equivalent of 280,000 years of processing time. Community computation enthusiasts hope it may lead to more-ambitious projects that let computers share not only CPU cycles but also memory, disk space, and network bandwidth.

Anderson sees SETI not merely as a global computational exercise, but as a gathering place for new communities.

"Several people are running SETI@home in the same town in Poland," he says. "We'd love to help them find out about each other. We haven't exhausted the potential for connecting people as well as computers."

The roots of community computation stretch back further than the creation of SETI@home. I first encountered the idea in the early 1980s, while conducting research in the library of Xerox PARC. Some of the most interesting reading was in the distinctive blue-and-white bound documents of internal PARC research reports. One, I remember, had an intriguing title: "Notes on the 'Worm' Programs – Some Early

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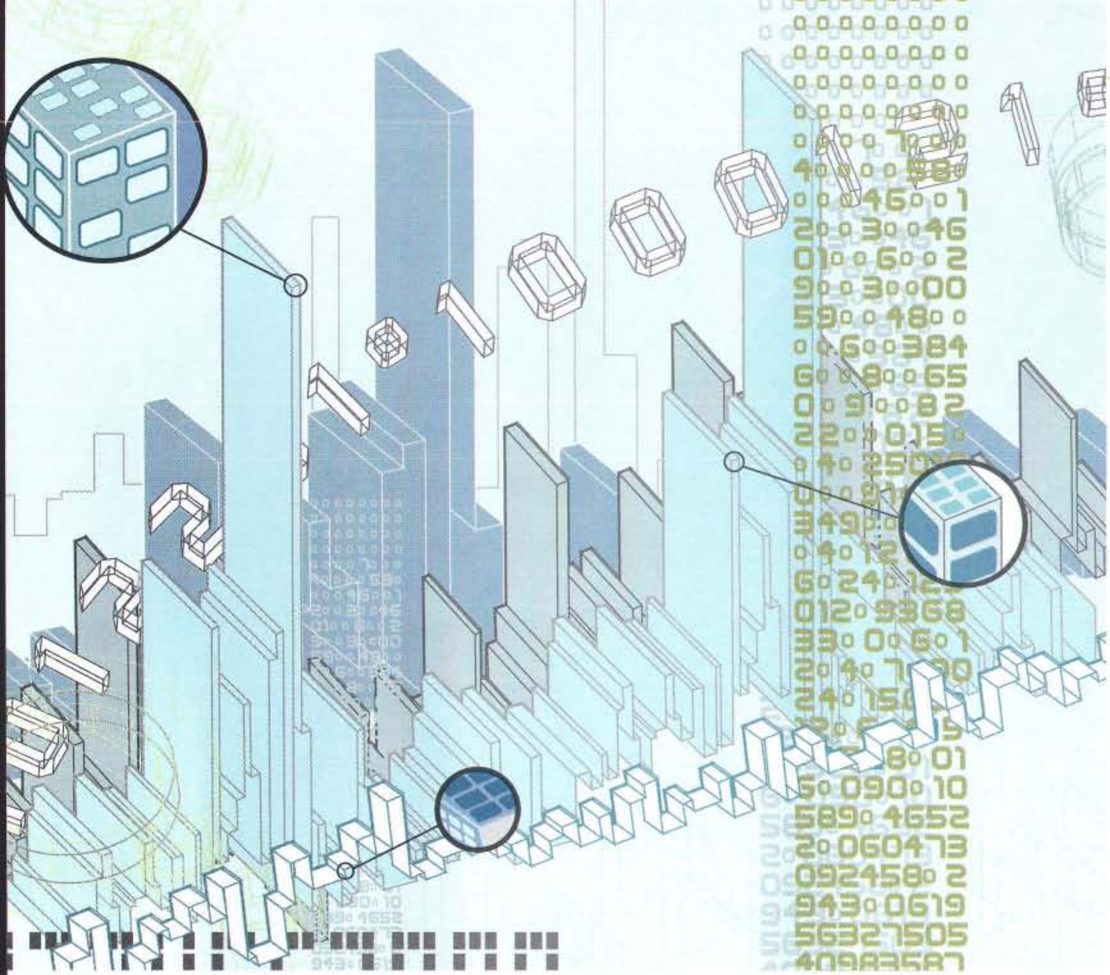

Experience With a Distributed Computation." The report, by John F. Shoch and Jon A. Hupp, detailed experiments with a computer program that traveled from machine to machine on a local network, looking for idle CPUs, sneaking in computations on any unused machine, then retreating with the results when a human started tapping on the keyboard – a local-area version of what SETI@home would accomplish on a global scale two decades later.

A 1975 sci-fi novel, *The Shockwave Rider*, by John Brunner, was part of the inspiration for the PARC experiment. In the book, Brunner describes an omnipotent "tapeworm" program running loose through a network. Brunner's worm is malignant, but the PARC scientists imagined a beneficial program that would move from machine to machine harnessing resources.

The PARC worm experiments took place on about 100 Alto computers linked via the first Ethernet. Shoch and Hupp's worms were able to roam through the network, reproducing in the memories of idle machines. Each segment performed a computation and had the power to reproduce and transmit clones to other nodes of the network. Shoch and Hupp created "billboard worms" that distributed graphic images – a popular means of getting "the cartoon of the day." Another prescient experiment was in "multi-machine animation": shared computations for rendering realistic computer graphics.

Doing this sort of distributed computation on a global scale wasn't possible in the early 1980s. The Net's population was measured in the thousands, and the bandwidth was puny. But by 1989, Richard Crandall, now Distinguished Scientist at Apple (and once my roommate at Reed College), started networking NeXT computers to find, factor, and test gargantuan prime numbers.

"Community supercomputing occurred to me one day at NeXT engineering headquarters," Crandall recalls. "I thought we ought to make these machines do what they were designed to do, which is to work when we humans are not working. Machines have no business sleeping."

Crandall installed software that allowed idle NeXT machines to perform computations, combining their efforts across the network. He called this software Godzilla, but after a legal inquiry from the company that owned the rights to the movie character, he renamed it Zilla. Crandall put Zilla to work on huge prime numbers, which are crucial in cryptography. It was then used to test a new encryption scheme at NeXT – a scheme now employed at Apple, which acquired NeXT. In 1991, Zilla won the Computerworld Smithsonian award for science.

Later, Crandall and several colleagues used distributed processing to complete the deepest computation ever performed, asking the question: Is the 24th Fermat number (which has more than 5 million digits) prime? "It took 10^{17} machine operations – 100 quadrillion," Crandall says proudly. "With that level of computational effort, you can create a full-length movie. In fact, that's about the same number of operations Pixar required to render *A Bug's Life*."

The day when animated movies are rendered with the help of networked PCs may be closer than many would've dreamed possible even a few years ago.

"Computation is becoming a commodity," says David McNett of distributed.net, a community computation effort that focuses on encryption cracking, as well as on scientific and academic work. "In the future, if Pixar needs to do *Toy Story 3*, instead of buying new machines, they can bid on the cycle market. That's what we're working toward."

> "Computation is becoming a commodity. If Pixar needs to do *Toy Story 3*, instead of buying new machines, they can bid on the cycle market."

distributed.net is a loose coalition of mathematicians, programmers, and cypherpunks who joined forces in 1997 to decrypt a puzzle devised by RSA Security, a leading vendor of encryption software that regularly issues open challenges to break its code. The distributed.net team wound up collecting the $10,000 grand prize and

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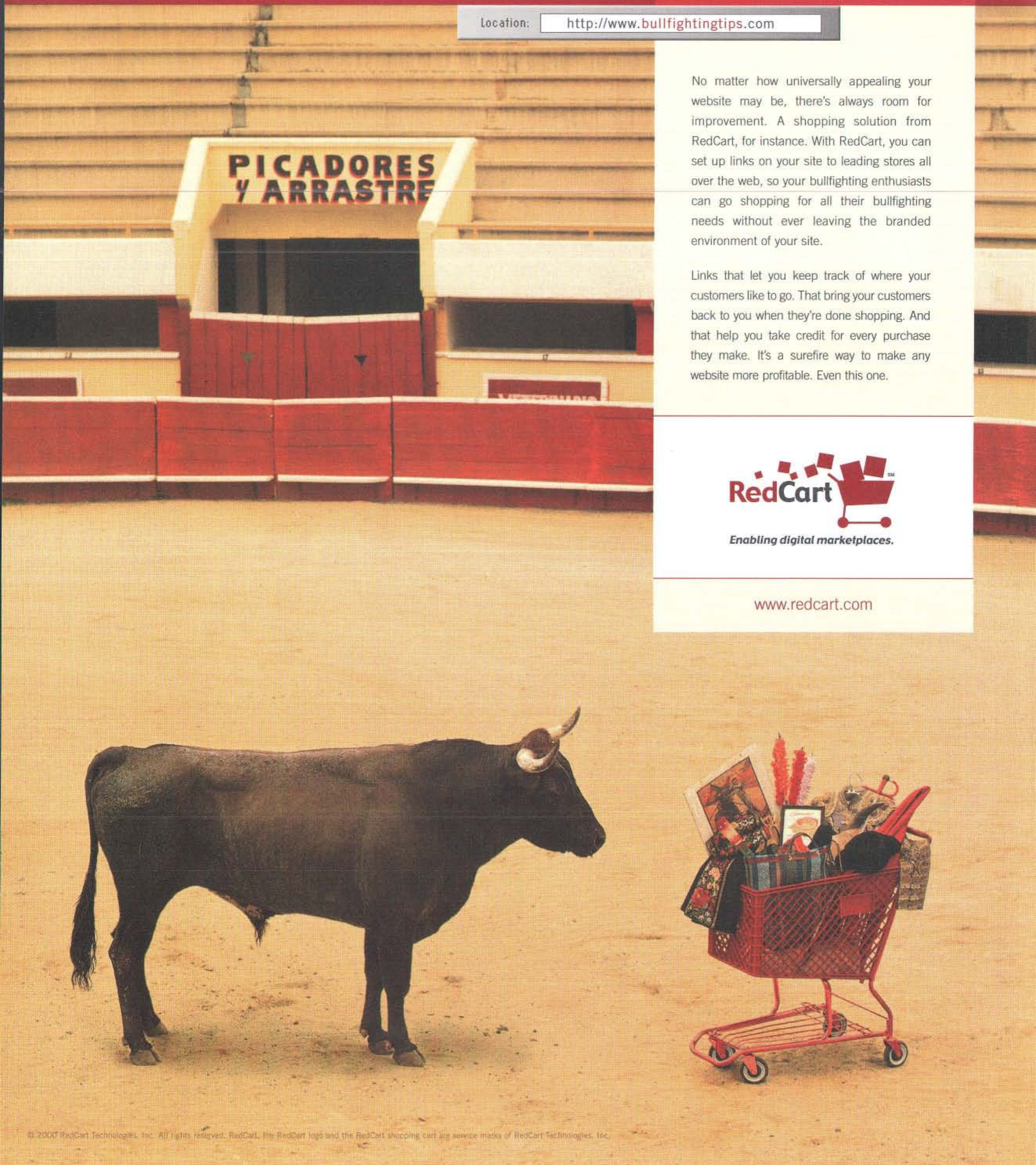

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plowed the money into a nonprofit research foundation.

"We knew that this technology could have practical uses," says McNett, "but there was little know-how to stimulate applications, so we did research by trial and error."

At its heart, distributed.net is an online community. The 15 founders met via IRC, and most have never seen one another in the flesh. Members are scattered across North America, Europe, South America, and Asia, and board meetings take place on an IRC channel. Says McNett, "We network people as well as computers."

Since its first successes with cryptographic challenges, distributed.net has moved on to work with the UK's Sanger Centre on human genome mapping, and boasts a community of 60,000 participants with 200,000 computers. distributed.net's computing power now equals that of more than 180,000 Pentium II 266-MHz computers working 24/7, and the infrastructure can reliably handle tens of thousands of additional new computers.

Multi-teraflop CPU communities already drub supercomputers – and *think* of all the PCs at Exxon that sit idle all night and on weekends.

Although the group is concentrating on not-for-profit research, McNett believes distributed computation is well suited to commercial applications. In the future, it could easily involve any organization with a large number of PCs: "Think of all the computers that Exxon or Coca-Cola own that sit idle all night and on weekends," he says.

Adam L. Beberg, a founder of distributed.net, started playing with cooperative computation over local networks in 1991, and designed his first network-distributed computation system in 1995. Now he's distributing developer toolkits so that anyone can build a community computation network. He calls his work-in-progress Cosm (*cosm.mithral.com*), a distributed processing architecture that will dispense with centralized servers. In Cosm's universe, all clients are servers for other clients on the network – similar to the way Napster and Gnutella work.

Distributed supercomputers may turn out to be useful laboratories for studying long-term environmental problems. Myles R. Allen of the Rutherford Appleton Laboratory in Chilton, England, has proposed that distributed computation be applied to the notoriously difficult task of climate simulation (*www.climate-dynamics.rl.ac.uk*). Last fall, Allen published a request appealing to the Web's civic spirit: "This experiment would introduce an entirely new form of climate prediction: a fuzzy prediction, reflecting the range of risks and probabilities, rather than a single 'best guess' forecast. And we don't have the computing resources to do this any other way. So, if you're lucky enough to have a powerful PC on your desk or at home, we're asking you to do your bit so the right decisions get taken on climate change." Allen received 15,000 replies within two weeks.

OpenCOLA is another community computing effort, an open source distributed search tool that uses idle CPU cycles to help maintain a noncommercial index of the Web's contents. Unlike commercial search engines, which pay for the necessary tasks of spidering the Web to update their indexes, OpenCOLA (*www.opencola.com*) relies on each participant in the community to pick part of the Web to spider in their spare time. Beyond searching and spidering, OpenCOLA could let open source enthusiasts join on-the-fly distributed networks. When one computer on the network learns that it has been given a computing task that lends itself to distribution (such as database conversion, image manipulation and rendering, or file-format conversion), it can poll the other computers connected to the network to find clients available to help.

The next hurdle for community computation is finding the right business model to turn this now largely social enterprise into a viable industry. Popular Power, for example, is positioning itself as an exchange for buyers and sellers of computing time.

Mark Hedlund, Popular Power's CEO, got the idea for the company after attending a presentation about SETI@home. Hedlund, who set up the Internet division for Lucasfilm, contacted his college buddy Nelson Minar, who'd been working on experiments at the Media Lab using independent computing resources and agents.

"The idea of trying to profit from distributed computation kept coming back into the conversation," Hedlund says. The pair contacted another friend formerly at Industrial Light & Magic, wondering whether selling CPU hours to render special effects was a viable business proposition. When his friend confirmed the need, Hedlund recalls, "I called a biotech firm, a chemical company, an environmental agency, a couple more entertainment companies, and they were all interested. I'm convinced there's a market."

Some of Popular Power's early investors have been software engineers yearning to do something meaningful. "A lot of engineers I talk to are tired of building ecommerce systems," Hedlund says. "They recognize that cooperative computing is what the Internet is meant to do. We've had no problem recruiting top talent."

As for the service, it works much the way SETI@home does. A Popular Power participant downloads software that functions as a screensaver, activating when the user isn't operating the computer. It goes to work on a piece of a large computing task and sends the results to Popular Power. When the user moves the mouse or presses a key, the software immediately suspends its community work. As part of a preview release, Popular Power is donating computing power to nonprofit ventures, as well as several commercial ones. For the company's first project, Hedlund hired a programmer who plans to use community computation to test influenza vaccine designs against epidemic data.

Rather than paying participants directly in cash, Popular Power hopes to partner with users' ISPs to knock $10 or so off their monthly fee or provide a gift certificate for an online store. Participants will receive a ranking based on the work they do for the system. When two users' computers are available for work, the user with the higher

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ranking will get first crack at the better-paying jobs. Participants can maximize earnings by working on commercial projects, or donate time to nonprofit projects, or mix the two. To allay security concerns, the software encloses programs in a container called a "sandbox" that limits what they are allowed to do and blocks access to the files on users' computers.

Popular Power is targeting businesses that do intensive computing - insurance companies, pharmaceutical giants - and is hoping to sell them on reducing their costs. Ordinarily, such a company would buy an expensive supercomputer or cluster, and then pay for maintenance and administration. The supercomputer depreciates almost as soon as it's put into service, and quickly competes against newer models. Community computation, however, would allow companies to buy only the computing power they need for individual projects, greatly reducing the cost. A small business could compete with a much larger one on computing projects without having to invest millions in infrastructure. And while today's fastest supercomputers top out at around 3 teraflops, Popular Power expects to be able to exceed that limit many times over.

A rival business model for community computation bears a resemblance to multilevel marketing. ProcessTree Network, a Huntsville, Alabama-based distributed processing startup, plans to sell cycles and reward participants for their CPU hours, then continue to reward them for signing up additional partners, and for the partners their recruits sign up. With plenty of computing power on hand to keep track of who is owed a microcommission, a multilevel CPU marketing scheme could well be viable.

Jim Albea, founder of ProcessTree, is a participant in SETI@home and another voluntary effort, the Great Internet Mersenne Prime Search. Originally trained as an architect, Albea now works in software development for Intergraph, a Huntsville company that built the architectural software he had been using. In the late 1980s, Albea had worked on a LAN-based distributed processing product for Intergraph that built animated video.

"I had been involved in voluntary projects, but had not thought much about the commercial applications," Albea recalls. "When the Mersenne prime was found in 1999, it hit me that distributed computation is poised to go commercial. I'm always looking for the next big idea. It felt like I had been asleep at the switch."

He launched the ProcessTree Web site (*www.processtree.com*) in January; the company merged with another service, Dcypher.net, in April. ProcessTree aggregates and cultivates the user network, while Dcypher.net will develop the technology.

As of June, about 29,000 people and more than 56,000 computers had signed up. According to Albea, "We're adding around 300 new people and 500 new computers every day."

Albea says that the real power of the enterprise lies in the community of volunteers, and the founders intend to keep the core team small. "We don't have much overhead," says Albea. "The big companies get themselves all wound around their axles trying to figure out the market, but we're going to create markets. The application that excites me most is the one I haven't thought of yet." So far, Albea doesn't have any clients he's ready to name, but says several Fortune 500 companies and animation houses are interested.

Community computation has its skeptics - Bob Metcalfe, the inventor of Ethernet and founder of 3Com, for one. A PARC veteran himself, Metcalfe has followed the distributed processing concept for decades, and calls it "one of my favorite ideas." But while Metcalfe sees progress on many fronts, he isn't convinced community computation can become a commercial venture.

"Big companies try to figure out the market, but we're going to create markets. The most exciting application is the one I haven't thought of yet."

"There aren't that many computational problems amenable to this kind of loosely connected parallelism," Metcalfe points out in an email. "The costs of transporting the data, program, and results of most computations overwhelm the benefits of the parallelism, and people with serious computations are not likely to trust results coming from unreliable machines owned by total strangers. Besides, the costs of computation keep going down, so why bother trying to recycle the waste of this renewable resource?"

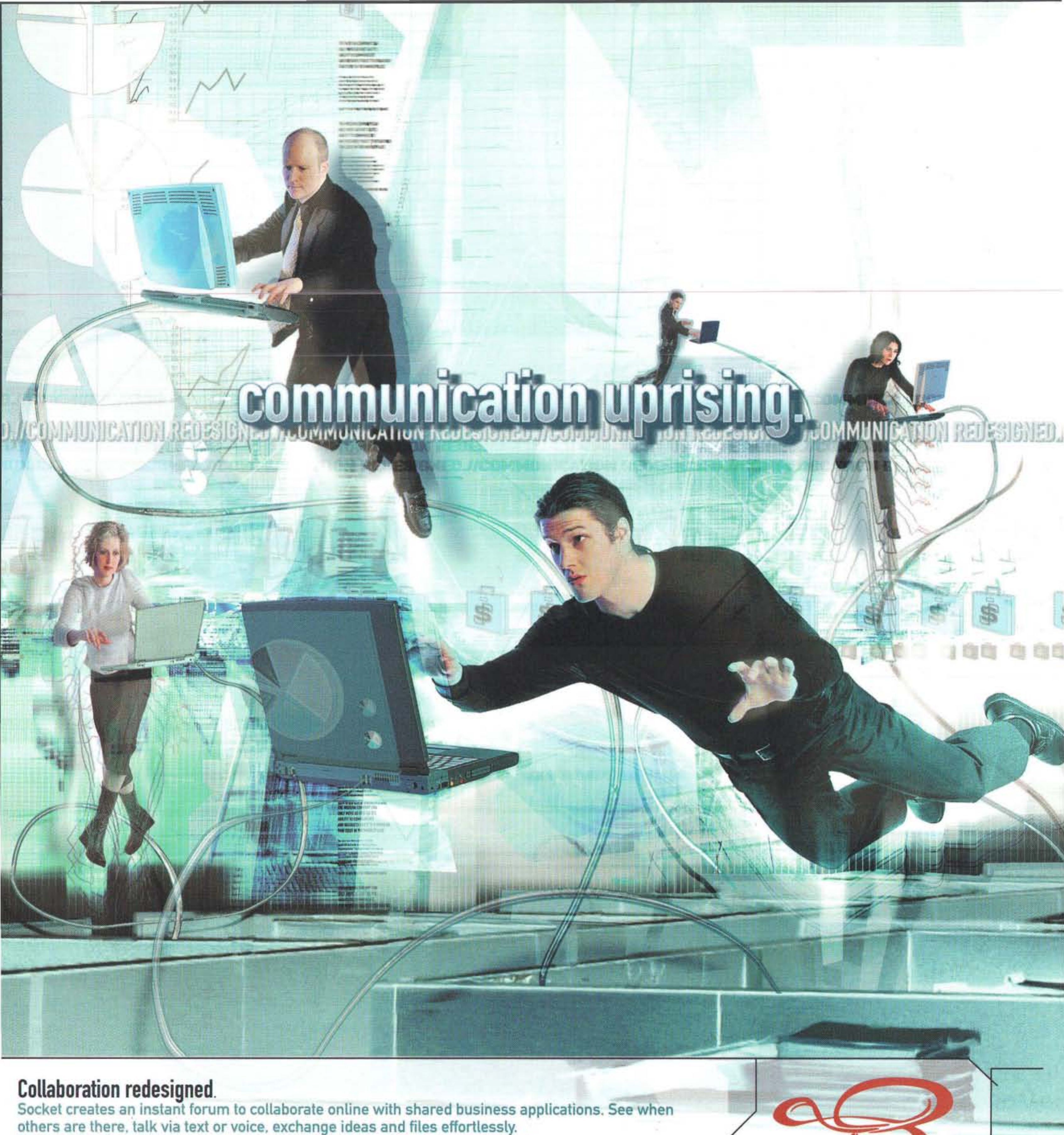
But Apple scientist Richard Crandall believes there are plenty of computational problems to make distributed processing viable. "The *problems* are out there, but the *software* is insufficient right now to optimize community computation," he says. "In principle, the costs are very low. Someone simply has to work out a proper business model and everything will follow."

Popular Power's Hedlund also disagrees that the costs of transporting data over a distributed network overwhelm the benefits. "Network speed and connectivity have finally reached the point where it's completely feasible to do nontrivial work," he says. "I think that SETI@home demonstrates this nicely."

Sharable resources aren't limited to CPUs. Uncounted terabytes of disk space and peripheral devices are often as idle as most CPUs. Within a few years, the world's computers will number in the billions - and tomorrow's models will be orders of magnitude more powerful than today's. But no matter how brawny individual computers become, they will never be as powerful individually as collectively. Community computation could be another amateur enterprise that grows into an industry, a disruptive phenomenon that changes everything from scientific research to entertainment. Reclaiming the world's idle computing resources could fuel the next stage of computing, the way Moore's law has for the past 30 years.

And it could all happen while you've stepped away from your computer. ■ ■ ■

Contributing writer Howard Rheingold (www.rheingold.com) *is the author of numerous books, including the newly revised* Tools for Thought: The History and Future of Mind-Expanding Technology. *He wrote about the Amish in* Wired *7.01.*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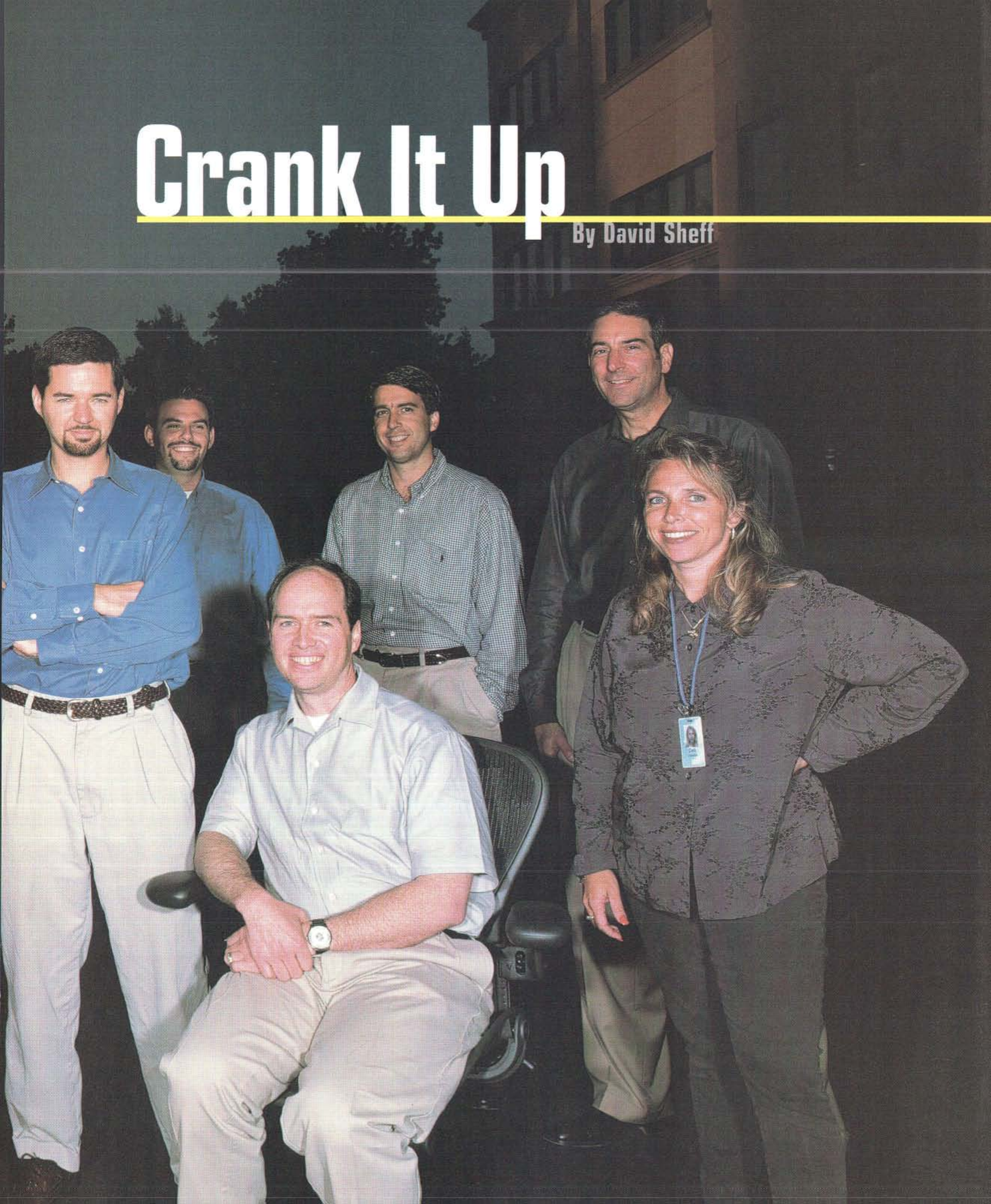
Marc Andreessen and his dream team at Loudcloud are building the Web's next power play: custom-designed, infinitely scalable sites that blast off a virtual assembly line.

The Loudcloud team at their new offices in Sunnyvale (from left): Marc Andreessen, cofounder and chair; Martina Lauchengco, director of marketing; In Sik Rhee, cofounder and VP of research; Tim Howes (seated), cofounder, VP of engineering, and CTO; Jason Rosenthal, director of business development; Scott Dunlap, VP of product management; Jonathan Heiliger, senior VP of operations; Ben Horowitz (seated), cofounder and CEO; Dave Conte, director of finance; Chuck Katz, executive VP of corporate affairs; and Deb Casados, VP of human resources. Photograph by Jeff Minton.

Crank It Up

By David Sheff



The lessons of Netscape loom large in Marc Andreessen's mind.

The company he founded with Jim Clark in the spring of 1994, the company that made him the Internet generation's poster boy and its first fresh-faced IPO multimillionaire, is a phantom limb, lost in the trenches of the browser wars. Yet more than six years later, at the weekly gathering of the executive committee of Loudcloud, the vehicle for Andreessen's second coming, he is still thinking about a $7 million check.

These days, in the industry that Netscape jumpstarted, $7 million is nothing – milk money – but in 1994 the amount was incomprehensibly large, particularly for the small-town kid who had recently pulled up stakes in the Midwest to settle in Silicon Valley. Running around the office, Andreessen showed off the check to each of Netscape's three dozen employees. The responses ranged from awe – "Holy shit!" – to disbelief – "Is that thing real?"

Accepting the check was a mistake, Andreessen is telling the Loudcloud executives. (For the many Netscapees who have gathered here, a key motto is "Make *new* mistakes.") "Jim Clark made a deal with MCI, which committed us to creating software to run its new ecommerce site, an early vision of an Amazon-like shopping mall called MCI Marketplace," Andreessen tells them. "Seven million dollars seemed too incredible to pass up. But what we didn't realize is that we were selling our soul." The check arrived, and the team was jubilant – but then Netscape had to fulfill its obligation to create software to MCI's specifications instead of software that would have been useful to a wide range of customers. "We became their indentured servants," Andreessen says. "A big early customer owns you."

Loudcloud's executive committee meetings are held each Monday. This one is taking place in an unadorned conference room called Notorious B.I.G. (another goes by the name Queen Latifah) at the company's temporary Sunnyvale, California, headquarters. For much of the meeting, Andreessen, who is Loudcloud's cofounder and its chair, seems distracted, checking email on his pager, twirling dials and pumping buttons as if it were a Game Boy. But he doesn't miss a thing. At one point, there is a discussion about whether a manager should be promoted despite his breach of the company's legal policy. Like every technology company, Loudcloud prohibits new employees from bringing any proprietary information from their previous employers, but the manager in question ignored the edict. As a result, a number of executives at the meeting are disinclined to approve the promotion. Says one, "He hasn't even shown any remorse!"

Andreessen strategizes with advisers Mike Homer (far left) and Eric Hahn (second from right), along with general counsel Chuck Katz (far right).

Without turning his attention away from the tiny screen, Andreessen gives his ruling: "Promote him, but give him 30 days in the stockade."

Yet when the subject of Nike is raised, Andreessen tucks the pager into his breast pocket and leans forward on his elbows. The Loudcloud sales team has been negotiating with the footwear giant, which could become the company's first Fortune 500 customer. Jason Rosenthal, head of business development, points out that signing a company of Nike's stature would be an enormous coup, particularly this early in Loudcloud's history, and with its hopes of an IPO early next year.

The members of Loudcloud's research and operations teams aren't so sure. The head of the research department, In Sik Rhee, says that he would first like to know if Nike's technological needs fall within the model the team has designed. If Nike uses technologies that Loudcloud doesn't support, Rhee argues, it would be a mistake to sign them up.

"But isn't it worth stretching for a company like Nike?" asks B. J. Bushur, Loudcloud's sales director. "I mean, *Nike*!"

That's when Andreessen tells the story of the $7 million check – one of countless moments in which he and Loudcloud's executives revisit the catalog of incidents and insights they carried away from their wild ride at Netscape.

"It all comes down to one thing: whether we are building a burger or a company," he says. "If we are building a burger, we take every customer that comes along and cash the checks as quickly as we can. But if we're building a company, we say no to any company that distracts us from the long-term mission."

There is some head-scratching. "A burger?"

"A burger is meant to be flipped," he explains, "whereas a company is meant to be here for the long term. It's the central issue in this company and it affects every decision we make. It affects who we hire, how we spend our money, how we incentivize our people, and whether we accept a customer that doesn't necessarily fit into our business model." And just in case anyone still doesn't get the point, he firmly concludes, "We aren't in the burger business."

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PHOTOGRAPH: RAIMUND KOCH

If not burgers, then what? The idea behind Loudcloud is simple, perhaps brilliantly so: to automate the process of building and maintaining Internet sites in order to provide Web-hosting services on an unprecedented (and unprecedentedly lucrative) scale. But the simplest idea is often the hardest to see, and Andreessen's act 2 has been a long time in the planning. For more than two years, even as he held the post of America Online's CTO following Netscape's acquisition by AOL and Sun, he scoured the digital landscape, searching for the perfect business.

The man he wanted at his side, more than any other, was his close friend Ben Horowitz, a popular Netscape and AOL manager. The 34-year-old Horowitz is thoughtful, methodical, and even-tempered (especially compared with the mercurial and occasionally morose Andreessen). He'd run several Netscape product divisions, headed up the company's directory and security product lines, and then managed AOL's ecommerce division – what basically became Shop@AOL, one of the largest shopping destinations on the Internet. "Horowitz was the manager everyone at Netscape wanted to work for," says Scott Dunlap, Loudcloud's head of product management. "The great VPs of Netscape all came out of Ben Horowitz. Ben helped people build careers and pulled together teams better than anyone else."

In Sik Rhee made the eureka observation that started it all.

Even as the other Netscapees scattered to the winds, Andreessen's inner circle – which included Horowitz, Howes, and several others – stuck together; they had bonded in the course of the extraordinary, short life of one company, and now they would seek redemption with another.

Andreessen says he never considered anyone else for Loudcloud CEO, not even himself. "Whatever value I can contribute to the company, they're getting it now," he says. "I would hate the job and I wouldn't be particularly good at it. I can contribute more if I don't have to be consistent. I am free to drive everyone crazy with new ideas and impatience. I'm happy to push people right to the edge. I don't mind pissing people off."

Horowitz, by contrast, tries not to, which is one of the reasons Andreessen wanted to work with him. They powwowed early on about the kind of company culture they envisioned, about trust and respect, and how to motivate employees in a business where talent is scarce and hard to keep. Modeling his management style after that of the man he claims as his hero, Andy Grove, Horowitz sets general goals for the company and encourages managers to set broad goals for their staffs. But whereas Grove is known for an almost ruthless analytic zeal (at Intel, one of his best-known maxims is "If you can't measure it, you can't manage it"), Horowitz is considered empathetic as well as effective, which may be why he is described by one employee as "the kind of person you would follow into a pit of fire."

As late as September 1999, when Andreessen resigned from AOL, he and Horowitz still didn't know exactly what they were going to do. But they knew where to find the talent to do it. First Horowitz tapped Rhee, the wizardlike engineer who'd been CTO of the ecommerce platform division at AOL, to serve as head of Loudcloud research. The Korean-born Rhee had also come to AOL via Netscape, after it acquired Kiva, another legendary startup. Rhee cofounded Kiva and designed its main product, an application server, the kernel of which still runs Web sites for E*Trade, Bank of America, Lucent, and others.

Then, in October, Tim Howes came on board as CTO and VP of engineering. A respected specialist in large-scale, high-performance Internet infrastructure, Howes authored LDAP, the Lightweight Directory Access Protocol, which is the Internet standard for directories. Loudcloud's founding team was complete. "It's a team of Internet stars – people who built some of the most impressive technologies on the Net," says Joel Yaffe, an analyst for Giga Information Group.

Throughout the winter, the four met around a table under the circle of redwood trees in the front yard of Andreessen's Palo Alto home. Dogs and cats underfoot, they batted around dozens of ideas for Internet startups. Each idea had a drawback. And because of the complex infrastructure requirements of state-of-the-art Web sites, it would take months to get any one of them up and running. "Before Netscape, 'months' was fine," says Horowitz. "Now, with the frenzy of development of new Internet companies, months could kill you." The group decided to do the groundwork first, so that they could simply drop in whatever idea they ultimately settled on.

It was Rhee who made the eureka observation, drawn from the experience of building Shop@AOL. Rhee and the others on Horowitz's team had been charged with bringing most of the popular Internet shopping sites onto AOL, offering them access to the enormous AOL user base. Eventually, that meant more than 300 merchants, from small online stores to Amazon and eBay. When a company went live on AOL, its traffic increased by a factor of 10 to 100, and the site often collapsed as a result. Crashing sites were unacceptable, not least because AOL's users naturally tended to blame AOL for these problems. Rhee had started researching potential merchants to determine the scalability of their sites. "Almost all of them were rickety systems," he recalls, "doomed from the start." He worked to jury-rig their sites so that they could scale up when they went on AOL.

Now Rhee suggested that Loudcloud toss aside all its ideas for Net companies and instead become the company that put other people on the Net. "I became excited about the idea," Andreessen says, "when I saw that instead of running one of the stores on the block, we'd *own* the block – we'd run the block." There were many good reasons for companies to pay tens and conceivably hundreds of thousands of dollars a month for someone else to do the technical dirty work. Loudcloud could get a Web site up faster – in a third of the time, Rhee and the others calculated. It could do so much more cheaply, since a company generally needs a dozen or more highly skilled technicians to do the job. But the most compelling argument for a one-stop shop for Web infrastructure was that companies lose focus on their business if they have to continually worry about their sites.

Web infrastructure, or Web hosting, was hardly a novel idea: There are hundreds of companies – from LogicTier and MimEcom to Intek and USinternetworking to AT&T and Siebel – that help other companies go, and stay, online. Like the rest, Loudcloud would lease space at data centers, setting up hardware, network, and storage systems. The difference – and the potentially enormous competitive advantage – would lie in a new level of automation.

"The dumb way to do this business would be to try to do what other companies do," Andreessen says. "For every customer, we could hire another 10 people to get them up and run them. It would work. But at the end of the day, there wouldn't be that much value. The business would only scale by the number of bodies you could hire, which means that your quality of service would degrade over time. We wanted to do this for hundreds and then thousands of customers without having to hire that many new bodies."

Tim Howes spearheaded the creation of Opsware to speed-build sites.

Which is where Tim Howes came in. He spearheaded the creation of Opsware – software that makes it possible for Loudcloud to put up a new Web site with a keystroke or two. Dedicated servers are automatically configured with standardized operating systems, storage devices, load balancers, firewalls, security systems, database software, and more. Once the site is running, Opsware monitors it on a 24/7 basis, "grabbing" new servers and replicating the configuration and databases – scaling up to deal with increased traffic, and adding whatever new capacity is needed, whenever it's needed, over the network.

Customers start by choosing from a menu of Clouds: a Database Cloud, an Application Server Cloud, a Mail Cloud, a full Web Cloud, et cetera. They pay a monthly fee, based on the capacity they need, but Andreessen notes that Loudcloud doesn't get a cent until a site is up and running, and that clients are guaranteed 100 percent uptime. If a client wants to add services – say, a shopping basket or a secure payment system – Opsware can drop in any number of new Clouds that can be switched on and off. If a new software version comes in or a new feature is added to Loudcloud's menu, it can be installed automatically on the systems of the customers that want it.

In a meeting with Loudcloud adviser Mike Homer – a Netscapee, investor, and close friend of Andreessen's – a pair of engineers shows off the new piece of hardware that allows the Opsware software to monitor every piece of equipment in the Loudcloud system. Through a barcode connector, each server and component will identify itself to the other components and to the Opsware that monitors them all. One of the engineers presses a button on the scanner and a wireless signal is sent to a computer that instantly identifies the component. The scanner is a pretty cool-looking toy, and Andreessen hogs it. When someone asks what he's doing, he replies, "Asteroids."

Loudcloud isn't trying to reinvent the wheel; it's using its expertise to select off-the-rack programs (from Sun, Microsoft, IBM, and Oracle, among others), design new ones when necessary, operate them in various combinations, and run them in a high-volume Internet environment. Scott Dunlap predicts that the venture will make existing Web-hosting operations "seem like the pre-assembly-line car industry."

But the model has its perils. "The [Opsware] software distinguishes them," says a manager of IBM's Web-hosting division in Europe. "But one wonders if it's too soon to push a standard. It could be the basis of their success or their failure." Rick Juarez, an analyst at Robertson Stephens, who is continually trying to explain the enormous sector of Web-hosting and other Internet infrastructure companies to the financial community, thinks the approach has promise: "If Loudcloud successfully pulls off this highly engineered approach, it will be a breakthrough. The chief risk is that they will try to be too sophisticated, and it will become too complex to use and too onerous to manage."

Benchmark Capital invested $15 million in Loudcloud, after the founders put up $8 million (the bulk of it from Andreessen) and before they secured $45 million in debt financing from Morgan Stanley Dean Witter. When Benchmark lead VC Andy Rachleff ticks off the reasons his firm anted up, he mentions the quality of the team, the enormous potential market, and the fact that Loudcloud's revenues should ramp up much faster than those of its competitors. "They're unique in that they're the first to allow a company to completely outsource the Web-hosting process," he adds. "Some manage up through the operating system, but Loudcloud manages through the application layer." He praises Horowitz for creating a productive management culture, and for being selective about Loudcloud's customers: "They want to be sure the customer is going to grow and provide more revenue."

Given the recent spate of explosive viruses and denial-of-service attacks, Loudcloud also wants to be sure its customers are protected. "Security concerns cut across everything we do," Howes says. "From the beginning, we had to consider it in every level of our offerings, from the servers to the application layers. The more sophisticated the black-hat community becomes, the more sophisticated we become." He says the all-important Security Cloud, part and parcel of every other Loudcloud service, uses off-the-shelf security technologies – such as Cisco's firewall system and NetScreen for the VPN connections – along with some proprietary additions, and includes complex password and intrusion detection systems. It got its first test when a hacker tried to shut down a Loudcloud customer's site as part of the broader attacks on Yahoo! and eBay et al. "The breach was detected and denial of service failed," says Howes.

PHOTOGRAPH: RAIMUND KOCH

When Andreessen first described Loudcloud's business to the press in January – "It's like providing the electric power grid, and companies can plug in" – it sounded pretty unsexy. "It *is* unsexy," says Giga's Yaffe. "It's meat and potatoes." Opsware isn't inherently dramatic; it's a way to speed and scale up what is now a difficult, labor-intensive process. Indeed, if Loudcloud's founder had been anyone but Andreessen, the company would not be getting anything like the attention it has received. But *meat and potatoes*? The world expects flash and innovation from the man who defined Netscape Time, who has been compared – persistently if erroneously – to Steve Jobs and Bill Gates, who appeared on the cover of *Time* barefoot and wearing a crown. Those expectations are Andreessen's blessing, and so, of course, they are also his curse.

Andreessen dislikes – no, dislikes is too weak a word – he *loathes* being asked about his background, and has walked out of interviews when questions about his family or his hometown (New Lisbon, Wisconsin; population 1,491) have been raised. When pressed, he becomes agitated, then sullen. Finally, he offers a feeble explanation. "I'm an introvert," he says. "I would hide if I could get away with it."

As disingenuous as that sounds coming from a highly visible, sometimes cocky industry leader who once called himself a "media whore," his reaction to personal questions hints at a real discomfort. Over the years, a relatively standard-issue geek profile has been constructed in the thousands of pages devoted to Andreessen. His mother, Pat, was a customer service representative at Lands' End, the catalog company. His father, Lowell, was a sales manager for Pioneer Hi-Bred International, a seed company. At his tiny high school, with 240 students, sports were the measure of a boy's worth, and Andreessen was both unathletic and uninterested. He learned to program from a book he read when he was in the hospital recuperating from an operation. On a computer in the school library, he built a calculator that could do his math homework. That night, when the janitor turned off the power to the building, the program disappeared.

His teachers and classmates remember Andreessen as a good student who liked computer science and math, as well as English and history. Ken Adams, who was principal of New Lisbon High when Andreessen attended, told *Fortune* in 1996 that "Marc had an intellectual capacity that could intimidate people." And classmate Clay Haschke said, "Marc just seemed to have a broader sense than the rest of us. Say we were talking about God or something. He would talk about it in a more complete way, with more than one view. And we'd sit back on our heels and say, 'Wow, oh yeah.'"

Reporters searching for Andreessen's backstory have been stymied by his silence on the subject, and more than one article has noted that since he left home, he has had little, if any, contact with his parents. But he has racked up an impressive list of mentors – father figures? – starting with Jim Clark.

The path that led Andreessen to Clark is one of the Internet's most familiar tales: In the early 1990s, a towering, round-faced, 21-year-old engineer with short hair and short pants was studying computer science at the University of Illinois at Urbana-Champaign and writing Unix code at $6.85 an hour for the school's National Center for Supercomputing Applications. He decided to devise a simple interface for all the functions of Tim Berners-Lee's World Wide Web. With Eric Bina, a fellow NCSA programmer, he spent three months of nights and weekends creating the original version of what they called Mosaic.

Andreessen now says that his goal was to democratize the Web – "Why shouldn't everyone have access?" – though he doesn't pretend to have anticipated the world-altering results. "The work was fun, but no one was taking it seriously," he says. "Everyone was looking at interactive television, which was going to be pushed at first by a single killer app: movies on demand. The future of the world was going to be determined by AT&T and TCI and Time Warner. Every household was going to be hooked up." The Internet? "It was thought of as a ploy – a low-bandwidth ploy," he says. "It was nerds

Cloud formation: Every other Friday, CEO Ben Horowitz convenes an all-hands meeting.

and scientists and typing. All that crap. That's what everyone thought – Microsoft and everybody else. I just thought, 'I may as well work on this now, and then when I get out of college I can go work for Silicon Graphics or Time Warner or TCI.'"

Instead, he went to work at a small software company in California, where he received an unsolicited email from Clark, the already famous founder of Silicon Graphics. Clark, who had heard about Andreessen and Mosaic, was fishing for new business ideas. The two met and discussed, among other products, a Nintendo online gaming service. One night, after several bottles of burgundy, Andreessen uttered the words that have since been reprinted in every telling of the Netscape saga: "We could always create a Mosaic killer – build a better product and build a business around it."

Clark raided Urbana-Champaign for Bina and other programmers handpicked by Andreessen, and then moved them to Mountain View, where he set them up in an office suite in the City Center building. Following the arrival of new CEO Jim Barksdale, formerly of McCaw Cellular and Federal Express, in dazzlingly short order Netscape became the fastest-growing software firm in history, and its browser, Navigator, emerged as the key to the Internet boom. Netscape's unprecedented success caught the technology industry off guard, but the major players – including Sun, Oracle, SGI, and, of course, Microsoft – soon saw the writing on the wall and switched their focus from interactive television to the Net. In addition to galvanizing existing technology companies, Netscape launched literally thousands of Internet startups. The Netscape IPO, in addition to making the team rich (Andreessen was suddenly a multimillionaire and Clark was well on his way to becoming the first Net billionaire), unleashed the headlong rush into the public markets. Ask the founders of any Internet company what inspired them, and there's a good chance they'll answer, "Netscape."

Going public as Netscape did, before making a dime in profits, was a revolutionary act. So was Netscape's business model. Andreessen says that both Clark and Barksdale were easily convinced not to charge individual users for Netscape's famous browser. How else would Navigator trounce Mosaic? Revenues would come from Web site building, ecommerce, email, and server software, as well as browsers for corporate customers and service contracts. The company grew quickly – after a year there were 1,200 employees – and brought in startlingly high returns. Andreessen recalls, "In 1995, from Q1 to Q4, Netscape's revenue went from $5 million to $10 million to $20 million to $40 million. No one had ever seen anything like that. It was faster than Lotus' first year, which was the previous record in software. Shit! That's it! We are a hit!"

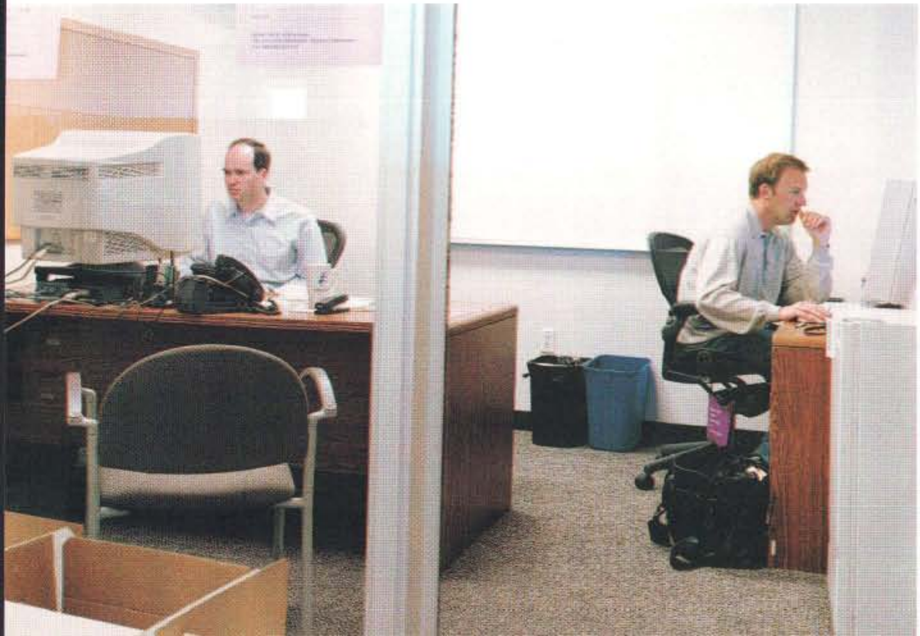
Revenues reached $100 million in 1996, which is when Microsoft began waging the browser wars in earnest, and other major software companies began to attack Netscape as well. A *Fortune* profile of Andreessen raised some prescient questions. "Is this 25-year-old programmer who never took a business course in his life an asset to his company? Can he help Netscape continue its phenomenal growth at a time when its market has been invaded by Microsoft? Is he anything more than a one-hit wonder, the Golden Geek of the moment?"

By the start of 1998, Netscape had hit a wall. It reported an $88 million loss, while its share of the browser market had dwindled from 80 to 60 percent. (Today it's less than 40 percent.) Analysts who had heralded Netscape as the most important new company in history were now sounding its death knell. As CTO, Andreessen had been somewhat insulated from day-to-day management, but six months earlier Barksdale had promoted him to executive VP in charge of Netscape's 1,000-person product-development group. Andreessen couldn't stop the implosion. Maybe no one could have. The company's role in instigating the Justice Department's investigation of the browser wars, and the resulting antitrust suit against Microsoft, turned out to be Netscape's greatest legacy – and the greatest factor in creating the widespread public perception that the company's demise came at the hands of Bill Gates & Co.

But these events obscured a critical fact: There was one road not taken by Netscape. While Andreessen and his colleagues were battling Microsoft and other technology giants for a piece of the enterprise software market, they failed to exploit what turned out to be the most important asset in the Internet world they had done so much to create: Netscape's Web site – for a time the most popular site on the Net – where people went to download the browser.

By now it's a favorite call of Monday morning quarterbacks to point out that Netscape didn't take advantage of its Web site's huge traffic even as fledgling Internet companies were fighting viciously for all those eyeballs. "Yeah," Andreessen admits, "we could have been Yahoo! – if Netscape was to become a $100 billion company, that would have been how to do it. There was a point in time when that could have been done." Instead, Netscape gave Yahoo! – as well as Excite, Lycos, and others – access to its traffic for a relatively

Horowitz and Andreessen in their office at Loudcloud's Sunnyvale headquarters.



PHOTOGRAPH: RAIMUND KOCH

small fee. By the time Netscape entered the media portal business with a refocused Netcenter, in the summer of 1998, it was too late. The company that launched a thousand startups and woke the world to the power of the Web had ended up looking the wrong way.

Andreessen recalls the genesis of this fatal miscalculation. "In a war, you have a battle plan up front," he says. "You get into the war, and shit is happening all over the place – people are being blown up. You have to make decisions about what to do with incomplete information. Looking back, though, given the same information at every point in time, I would have made the exact same decisions over again." At the time, he notes, "Everybody in the Valley thought that Netscape had a clearly superior business to Yahoo! – financials ultimately drive almost everything a company does, even companies that are idealistic and try to pretend that is not the case. Our revenues had been doubling each quarter. I don't know how many people would have switched the model at that point."

"Yahoo! didn't have anything to lose," Barksdale notes. "We did."

True enough. The only hitch in this logic is that Marc Andreessen *did* see how the Net would change the world. In speeches, he described the digital future with uncanny foresight. But he didn't push his vision on his older, more experienced colleagues. Quite the contrary. And this fact speaks volumes about who Andreessen is – a very different person from the image created by his Netscape stardom.

For one thing, it explains why the comparisons to Gates and Jobs are inaccurate. Andreessen has always been a man of many mentors. Since he was thrust into the limelight by Clark, Andreessen has had the backing of some of the industry's heaviest hitters, including John Doerr (of Kleiner Perkins Caufield & Byers, the VC firm that backed Netscape), Jim Barksdale, and Peter Currie, then Netscape's CFO. "Barksdale influenced Andreessen into wanting to become a businessman," says one longtime observer. "A good manager, to be sure, but a businessman rather than what Andreessen is innately: a revolutionary thinker. Marc wasn't able to be both." (Barksdale also radically improved the punctuality of his young protégé, by locking him out of one of Netscape's morning meetings.)

While the world was lionizing him as a Gen-X icon, Andreessen was telling *Fortune* that "the stuff that interests me is business strategy and customers.... There's a triangulation between what's possible with the technology, what business needs people have, and what's actually practical. You triangulate on that, and that's where the sweet spot is for making a successful business and driving it further." That's a sharp contrast to someone like Steve Jobs. When Jobs brought in Pepsi CEO John Sculley to run Apple, the almost instantaneous conflict between Jobs' visionary drive and Sculley's practical-minded company-building led to Jobs' exit.

Instead of pushing for Netscape to become a Yahoo!-like media company and portal, Andreessen was following the lead of Barksdale, Currie, and Doerr, trying to create a bigtime software company – and not a sexy software company, either, but one that focused on the intranet infrastructure of corporate computer networks. "There was money in this, there was no money in that," Andreessen repeats. Of course, Jerry Yang and David Filo proved him wrong, but as Jim Barksdale points out, "They didn't have anything to lose. We did."

Still, it remains one of the central ironies of the Netscape saga that Yahoo! would finally disprove the theory that no one could beat Microsoft at a business Bill Gates wanted. Compounding the irony is the fact that Yahoo! built its audience on Netscape's back; and that, in the Web's early days, when Andreessen was a budding celebrity and Yang and Filo were penniless Stanford grad students running a cultish directory service from which no one could see a proper business being built, Netscape passed up the opportunity to buy Yahoo! for a song.

To this day, Andreessen, like Barksdale, defends Netscape's accomplishment as worthy of admiration and respect; for him, the bottom line is that "in a little over five years, Netscape created $10 billion in new wealth out of nowhere. In particular, anybody who ever bought a share of Netscape stock and held it made money. Name another Internet company for which that is true! There is none. And two, Netscape made Loudcloud. That's all I need to know."

Andreessen faced another problem: As the Net's first Rich Kid, he bore the weight of the media's need to create stars, and suffered the backlash that inevitably follows in the quest for a different story line – a backlash that was heightened, perhaps, by the fear and jealousy of aging baby boomers. Almost as soon as *Time* had literally crowned Andreessen, the efforts to debunk him started: He hadn't really had the idea for Mosaic; he'd stolen credit from other programmers; he was a fraud. The accolades for his Netscape achievement were thrown into question, then Netscape itself was gone. His first professional experience hadn't been a simple success, but a success-disaster.

Given the drama of Netscape's rise and fall, the comings and goings of its executives were followed with the rapt attention once reserved for the love affairs of movie stars. Jim Clark famously pursued the new new thing (the latest: Shutterfly). And CEO Jim Barksdale left soon after Netscape was divvied up by AOL and Sun, launching a VC firm with former CFO Peter Currie. But the wunderkind inventor of Navigator mystified many by remaining at AOL as CTO, while Netscape dwindled into a glorified R&D wing of a mass-market service and content provider.

To those close to Andreessen, his departure was only a matter of time. Andreessen insists, however, that he had wholeheartedly committed to AOL: "Committed? I committed! I bought a house in Virginia! No one else did that!" He was intrigued by AOL, he says, because "more than any other company, AOL is in a position to bring the Internet to the rest of the world. They are the ones who will double, triple, quadruple, and quintuple the number of people on the Net. I wanted to stay on and see what I could do."

There are varying reports about how well Andreessen and Steve Case got along. During negotiations for the AOL-Sun acquisition of Netscape, Andreessen presented Case with a report on the future of AOL that included a list of the "top 10 threats" to the company. (He and Horowitz now keep a changing list of the top 10 threats to Loudcloud: At the moment, "growing too fast" is right up there.) Case was impressed, but according to Rob Enderle, another analyst at Giga Information, "Case didn't know what to do with Marc. He gave him the title and a lousy office, and that was about it." Barksdale sharply disagrees, saying, "Steve saw him as an important asset."

Andreessen is short on the specifics of what he accomplished at AOL – he mentions "some decisions about technology" and the acquisitions of the Internet music startups Spinner and Winamp – and says his main goal was "to figure out ways to help them build on what they had." It may be that he was biding his time, torn between fresh ambitions and the lingering wounds that ambition had already inflicted. Meanwhile, Case was plotting a new course for AOL: the merger with Time Warner. "Knowing Marc, being lost in AOL Time Warner would have been akin to being burned alive," says Mike Homer. Ben Horowitz adds, "Marc has big ideas and wants to see them enacted yesterday. You can't do that in a big company like AOL."

"When I project five or ten years down the road, I want to look back and realize that I was at the creation of something great," Andreessen says now, and it's clear he doesn't consider Netscape to be that legacy.

Present at the creation, Loudcloud's founders have since reeled in some of the Valley's hottest talents. Jason Rosenthal, Horowitz's director of product marketing at AOL, had quit his job and was planning to spend two months mountain climbing when his former boss told him about Loudcloud. After meetings with the other three founders, Rosenthal was summoned to Andreessen's house. He was nervous, and taken aback by Andreessen's first question: "How is your sense of smell?" Rosenthal said he thought it was pretty good, whereupon Andreessen explained that his is very weak. The chair of Loudcloud had a date that evening and was convinced that one of his bulldogs had had an accident in the house. He asked Rosenthal to try to find it. Followed by Andreessen, Rosenthal sniffed about, but he couldn't detect anything malodorous, and the two got down to business. Before the afternoon was over, Rosenthal had agreed to join Loudcloud as director of business development and marketing.

Andreessen took Chuck Katz, of the law firm Perkins Coie, which represented McCaw Cellular and Amazon (he's also the husband of Netscape's former general counsel, Roberta Katz), out to dinner and persuaded him to sign on as Loudcloud's chief counsel. "The original Netscape browser that made the Web accessible and that Microsoft copied in a far less elegant way is a reflection of Marc Andreessen's brain," says Katz. "It is incredibly complex and yet simple, a portal to where we want to go. You don't meet people like that very often. When presented with the opportunity, you want to be in the same stadium." Over a beer, In Sik Rhee pulled in Jonathan Heiliger, who at 23 has quite a résumé – Global Crossing's GlobalCenter CTO; founder and senior VP of Frontier Internet Ventures – and is considered one of the most innovative operations executives in the business.

Scott Dunlap joined by quitting E.piphany on the day of its IPO.

But the greatest gesture of faith in Loudcloud's future may have come from product management VP Scott Dunlap. Dunlap's two years at E.piphany were about to pay off handsomely; the company was going public in two weeks. Then he met with Andreessen. On the day of the E.piphany IPO, Dunlap gave notice. "I can teach a course now in How to Ruin Your CEO's Perfectly Good Day," he says now. (At the meeting in which he announced he was leaving, one colleague hurled a telephone at him.) The move cost him millions of dollars, but, he says, "I saw the light in Marc's eyes."

When Rosenthal was told to sign up Loudcloud's first customer, he said he could do so within six weeks. "What takes six weeks these days?" Andreessen responded. Rosenthal landed Acteva in a week, and in the next few months a half-dozen small to midsize Internet companies signed up. Chris Wong, the CEO of SkillsVillage, an early customer, says that his company had put up its own Web site, but it was a fiasco. "I was losing sleep," he says. "And it wasn't what I wanted to spend my time on." He knew Andreessen – who is an investor in SkillsVillage – and had heard about Loudcloud. He says he jumped at the opportunity to do business with Andreessen's company: "Nothing like being able to hire the architects of the Internet to make sure your site goes up and keeps running."

But even as the talent and the clients keep rolling in, there's another lesson from Netscape that keeps Andreessen and Horowitz up at night: trying to get around the Law of Crappy People. "It scares the shit out of me," says Andreessen. "The law applies to every company that gets big," says Horowitz, "especially companies that get big fast, so we're a prime candidate.

"All you have to do is hire one person who isn't very good," Horowitz continues. "The Law of Crappy People kicks in because the worst employee at any level becomes the de facto standard for that level. Your executives sit around the table. Some EVP wants to promote one of his or her directors to vice president. Or maybe they want to bring in someone new. Someone at the table says, 'That person isn't good enough,' to which the first person responds, 'Hey, you've got Joe Schmo, who is a bonehead. This guy is better than

Joe.' So the guy who hired or promoted Joe Schmo shuts up."

Andreessen says, "You will inevitably make a mistake. The minute you do, the quality degrades. A people hire B people, and B people hire C people. So the bad people breed like rabbits – they hire more people like themselves or worse. We saw it happen at Netscape when we ramped up early on."

To avoid the inevitable, Horowitz and Andreessen are trying some unconventional tactics. One of the first employees – number 9, in fact – was a recruiter, Jeanne Romano. She'd had no interest in an office job, but loved the idea of building a company "from the DNA." "People in-house have more skin in the game," she says. After three months, 3 of Loudcloud's 100 employees were recruiters; now there are 7 on staff. Similarly, though business schools teach their students that an HR department should be in place by the time a company has 150 employees, Loudcloud hired an HR person when there were only a dozen.

Six months after it was founded, Loudcloud had nearly 200 employees. There will be 300 by this fall. In October, the operation moved from Andreessen's home to a grim office on Independence Drive in Menlo Park with a long line of Costco folding tables and workstations plugged into a daisy chain of extension cords. Ray Suorsa, another highly regarded engineer who signed on to work with Howes' team, says, "It was the most dangerous place I've ever seen. Each time a new employee arrived and plugged in a computer, everyone would take a breath to see if the whole table would go down."

"Ben takes every detail seriously," holding weekly one-on-ones.

When the Independence Drive office was bulging at the seams, Loudcloud relocated to an equally nondescript space on Tasman Drive in Sunnyvale: several rooms filled with quartets of cubicles and the standard tech company complement of Nerf guns. Jonathan Heiliger's NOC, or network operation center, crowded with a dozen computers, was described by one of its occupants as "a modest hell." Andreessen and Horowitz shared an office, with a tiny refrigerator stocked with healthy snack foods on Marc's side, and, on Ben's, a glass-encased Oakland Raiders football helmet signed by the entire team – a gift from the Morgan Stanley Dean Witter bankers who hope to handle the Loudcloud IPO.

"An environment in which you are breathing down each other's necks is incredibly exciting," Andreessen says. "You don't want to lose the energy of all those people creating and complaining. At Netscape, after all the whining about doubling up in cubicles, being packed together, we moved into the fancy, spacious buildings on the Netscape campus. Everybody had big cubes, and it was all spread out and everybody had things exactly the way they wanted. The buzz was gone, the energy was gone. The lesson: Pack them in to the point where they're just about to riot."

But the Tasman office couldn't hold Loudcloud for long. And in late May, despite Andreessen's belief in cramped creativity, the company headed for a roomier, more permanent home.

Andreessen drives a monster Yukon (when he's not driving a monster Mercedes), which has a copy of Dr. Spock's baby book on the passenger seat. Before the book can be misinterpreted, he explains – emphatically – that it was a gift from a potential Loudcloud customer, drspock.com. "I had better get rid of it so that no woman gets the wrong idea," he says, as he heads away from the Tasman office.

Though Andreessen has lived and worked in the Valley for most of a decade, he overshoots the freeway exit for his destination. The Yukon glides off at the next ramp, which happens to be the one that leads to the corporate campus of Netscape. Andreessen turns into the parking lot and the car weaves past a half dozen Netscape buildings. "It's a ghost town," he jokes. "They rent out all these cars and park them in the lot so that it appears that there are people in there. I went inside recently and there's no one – it's empty."

After getting back on the freeway, Andreessen pilots the Yukon to Loudcloud's new headquarters, a scaffolded, three-story, green-and-cream building that he calls "the Taj." Though he seems proud of its sprayed stucco exterior and jade-colored tiles, the building makes him nervous. "You're doing great and then you make the key mistake: You build a monument to yourself," he says. "We did it at Netscape. The Edifice complex worries me because it has marked the beginning of the end for many companies. I worry that employees will see this building and think, 'Man, we've made it.' You've never made it."

This Netscape lesson notwithstanding, Andreessen is resigned to the Taj, partly because more space is needed, partly because "it's not real expensive, given the Valley," and partly because he knows that Loudcloud needs the right public face. The lobby has a comfortable waiting room that shows off the NOC, which is visible through portholes. The NOC guys have traded their modest hell for some "très élégant" new digs, because, as Heiliger says, "customers like to see bits flying across big, flat-panel screens."

These and other details were on the agenda at a late-spring meeting, just before the big move. Dave Conte, who designed the Taj, arrived with rolls of plans and carpet samples and unloaded them on the conference table before presenting the executives with a heady problem: "How fancy of a lobby is too fancy and how fancy is not fancy enough?"

Choosing carpeting, tiles, and other features was particularly tricky, since the Taj costs had risen. "We are talking about spending $5 million to move in, for everything from phones to security to chairs," Conte said. "That is a sizable investment – in Netscape territory," added

Horowitz. "It's a lot, but it may not be outrageous for a company that plans to be around awhile. This will be our headquarters as we grow."

Jonathan Heiliger wanted to know if the new conference rooms would have names. "Let's stick with rappers," Horowitz replied.

"How about dictators?" asked Scott Dunlap.

There were suggestions from around the table: Kabila (as in "management training in Kabila"). Khaddafi. Idi Amin. Pinochet.

Then Jason Rosenthal weighed in. "How about serial killers? All-hands meetings will be held in Manson."

"Why don't we name them after Supreme Court justices?" asked Chuck Katz, the general counsel, effectively ending the debate.

At the end of the day, in the dining room of the Lion & Compass, Andreessen and Horowitz ordered only appetizers, since both had dinner meetings that night. Then Loudcloud's chair and CEO took a moment to reflect on their latest triumph: signing a deal with Nike. "We did it on our terms," said Andreessen. "Everything we're doing for Nike is applicable to all of our customers. We waited to take on someone of Nike's size, but we're proving that we're ready to ramp up to other big customers." Within weeks, four more customers would sign on: Echo Online, Gamers.com, Mercury Interactive, and OneClip.com. By June, the list had grown to include Acteva, SkillsVillage, HomeGain, CFOWeb.com, Catapulse, Wish.com, Dunlap's alma mater E.piphany, drspock.com (of the baby book), ZapMe!, StatementOne.com, and Epoch Partners.

Along with the high-fiving, there was an earnest discussion of management techniques. Horowitz expounded on the precise, careful system he has put in place at Loudcloud: He holds weekly one-on-ones with his managers, and whereas most companies give performance reviews once a year (and even those often fall by the wayside), he insists that every employee be reviewed – and review his or her manager – every 90 days. "These days, who can even remember what happened six or nine months ago?" he asked.

Loudcloud quickly outgrew its last office space. By fall, it will have 300 employees.

PHOTOGRAPH: RAIMUND KOCH

Andreessen listened approvingly. "Ben takes every detail seriously because he genuinely wants to build a company better than anyone has ever built one," he said. The day had been spent on the less glamorous aspects of starting a company – such mundanities as lobby tiles and the frequency of performance reviews – but the notoriously impatient Andreessen appeared to be in his element.

Andreessen is speaking at a conference for Indian entrepreneurs, at 2 pm at the Fairmont Hotel in San Jose. Though the hour is approaching, he ignores the voice of his Mercedes' in-dash navigation system and detours to the Taj – he doesn't want to get to the hotel too early. "I hate schmoozing," he says. After the drive-by, he realizes that he will still arrive at the hotel with minutes to spare, so he reverses direction and heads for his home in Palo Alto, where he checks on the two bulldogs and Australian silky terrier in the backyard. (They have their own fountain and a cushy bed built into the concrete fence.) "I have a surprise for you," he teases the dogs. He's flying to Los Angeles after the speech to retrieve a third bulldog.

"I don't like risk," says the man who inspired

When he was at Netscape, Andreessen was a famously bad public speaker – "excellent for insomniacs," in his own words. But after some coaching, he can hold an audience with a well-articulated vision and a few well-rehearsed jokes. Driving to the Fairmont, however, he spends much of the time talking about how best to cancel. "The difference between me now and a few years ago is that I would have canceled then," he says. "Or just not shown up."

It's a quick speech and a resounding success. Andreessen quotes Sun chief scientist Bill Joy, describing the evolution of the Net over the next five years as "not one Web but six Webs" – PC, wireless, interactive TV, telephone, embedded (in appliances), and business. The Internet, he tells the crowd, is "the first medium based on software. So it's the first medium that can continue to evolve and adapt and mutate." Pulling out his RIM pager, he makes the audience laugh by predicting that in the future, "humans will have very long and very narrow thumbs with many more joints. Now I have carpal tunnel syndrome, but only in my thumbs." He ends with a plug for Loudcloud, of course: "AOL, Amazon, Yahoo! had to do it for themselves. Now we can provide it for everybody." Afterward, he is swarmed by audience members who pepper him with questions and business cards. A number of them want to sign up with Loudcloud.

The burger-eating, moon-faced kid who shook the tech industry has become, at 29, an elder statesman. He can (and does) talk tech with everyone from Larry Ellison to Al Gore to Nasdaq president Alfred R. Berkeley III to AOL board member Colin Powell, and he's accruing some of the trappings of moguldom. Witness the new house in Malibu, where he parks his latest toy: a Hummer that belonged to Arnold Schwarzenegger, for which Andreessen bid $140,000 at a charity auction last May. When he walks into a room, the energy in the space increases, as if someone had cranked up the volume, treble, and bass all the way. He's fit (thanks to a workout routine and those raw veggie snacks) and polished, with a sharper wardrobe and a less-sharp tongue.

During a disastrous presentation from the representatives of a PR company, for instance, it becomes obvious that Andreessen would like nothing more than to lunge across the table and choke someone. Instead, in a measured tone, he tells them, "Next time you'll do better with us if you bring us choices instead of presenting us with one option." Later, Mike Homer cites this as an example of how his friend has changed. "He could have destroyed them, but he chose not to," Homer says. "In the old days, he would have."

Jim Barksdale, who had to cover for some of Andreessen's brasher comments about Microsoft, lamented during the trial that his protégé "often says things that I wish he wouldn't." But today, Barksdale notes, "it's so impressive to see how much he has grown – as a businessman, as a person." Barksdale can rest assured that Andreessen has – at least in public – perfected the art of circumspection when it comes to his old nemesis. Asked about the Microsoft antitrust trial, Andreessen says, "I am satisfied that the court has been able to handle this. It is really hard for me to have an opinion at this point. Part of it is that I am conflicted – I am a partner of Microsoft now."

a generation to take risks their parents never dreamed of.

Most people who have been with Andreessen from Netscape to AOL to Loudcloud remark on his maturity. Homer calls it "studied restraint," adding that "it's still hard for him when he sees the way things should be but aren't. It is almost as if Marc is standing in the future. It is as if he is compelled to act because of what he sees there. It is a little like a *Twilight Zone* episode."

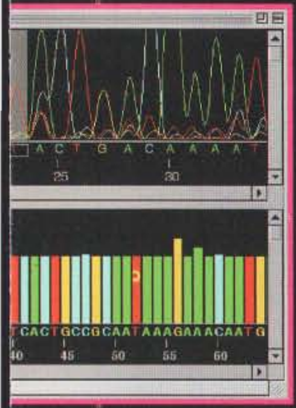
Though Andreessen acknowledges that Loudcloud's business is "picks and shovels," you wouldn't know it from the rock-star atmosphere that surrounds him. As Chuck Katz notes, "Whatever Marc does is electrified – it just is. Even if he's not setting out to change a paradigm, it happens. It has to do with the compression of time." Katz may be right. If Andreessen says that time is shifting again, hang on. Netscape Time, or Internet Time, as defined by Andreessen, originally described the time frame in which Netscape delivered new products, which was every six months, phenomenally faster than anyone had done before. Now Internet Time has come to define the speed of life in the age of the Internet – how quickly a company must move if it is to succeed. Scott Dunlap, remembering his first meeting with Andreessen, says, "Marc recounted how the Internet has changed the concept of time. Then he showed, step by step, how Loudcloud is going to again compress time, and not by a trivial amount. Time will change again now, this time by a magnitude of three to five. Well, here was the guy who started the whole thing and he was back for more. Another paradigm shift was coming."

Given Loudcloud's substantial (and mounting) competition, there's no guarantee that Andreessen will end up spearheading whatever paradigm shift his company represents, but there's certainly a large pie to be divided up. Dataquest forecasts that the broadly defined Web-hosting market will be worth $5.9 billion by 2003, up from $1.6 billion last year. And, in its arena, Loudcloud has a lot going for it: a chair who's in peak form, a CEO with unusual management skills, and the software expertise of Tim Howes' team. Robertson Stephens' Juarez is "cautiously optimistic" about Loudcloud's future. "The opportunity is there, but no one is overly optimistic," he says. "There are just too many unknowns."

Whatever happens, Loudcloud is about to reveal what is perhaps the most interesting lesson of Netscape, and that is a lesson about Marc Andreessen: who he really is and where he wants to go. "I am not risk-averse, but I don't really like risk," says the man who inspired a generation to take risks their parents never dreamed of. "I don't like mountain climbing or snowboarding or hang gliding. Some people are excited about stuff like that, but I prefer to go home and relax. Risk freaks me out, and I try to minimize it. So while I enjoy the part of this venture that is a startup – the adrenaline that comes with the creation of a new company – it is less risky, since we have done it before. There is much that is known now that was unknown five or six years ago when we started Netscape. It is a better time to do a startup now."

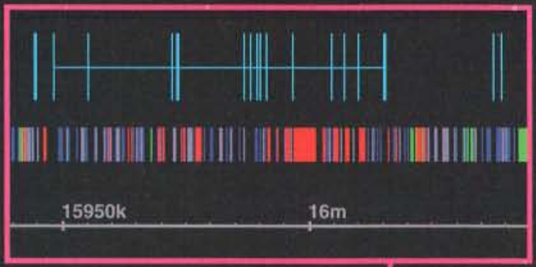
The chair of Loudcloud is, in the end, not inclined to be a barefoot visionary. This is not a man who wants to leap, à la Jim Clark, from one new new thing to the next. "Do I want to put a lot of effort into something that is going to be around for a short period of time?" he asks. "If you do that, you just have to do it over again. Both here and at Netscape, it got more fun as time went on. It's even more fun now than it was three months ago. At the beginning, it's very frustrating not being able to execute. As time goes by, the more people we hire, the better the organization runs, the more customers we have, the more management we have, and so on – the more fun. Jim and others have a completely different outlook. For them, it's less fun as the company gets more established. But I am interested in staying on for the long haul, building something great and maintaining it."

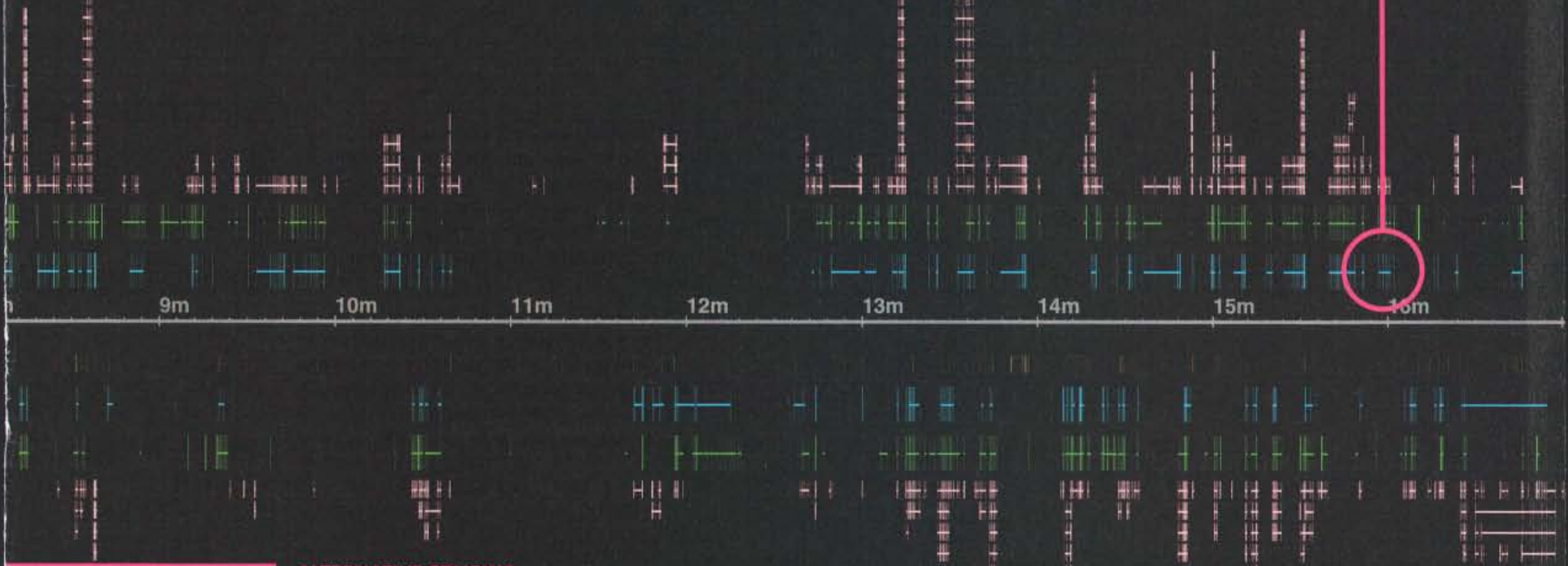
Marc Andreessen showed the Valley just how golden the future could be, and in the process became the inspiration of every ambitious, techno-savvy kid in America. Nice work if you can get it, but what mattered more to him was the company he lost. After wandering in the wilderness at AOL, he returned to a hero's welcome, drawing the smartest minds in technology to his side. And what is it he wants to build? A business. A good, safe, solid, long-lasting business – and if that sounds boring, tell it to Andreessen. He'd be happy to hear it. ■ ■ ■

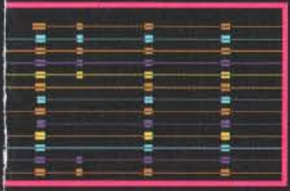


TRACE

The sequencing machine is the workhorse of genome research. A DNA sample goes in one end, a string of As, Ts, Cs, and Gs – the raw data of bioinformatics – comes out the other. Inside the hulking machine, the sample is analyzed for the presence of adenine, thymine, cytosine, and guanine – the nucleotides that make up the base pairs. The wave pattern that illustrates the levels of each chemical is called the trace. Peaks of adenine are recorded as As, thymine peaks as Ts, and so on. In some cases, the machine can't determine the base, either because the levels of each of the four chemicals are roughly equal or because the sample is damaged. The level of certainty is indicated by the height of the colored bars at bottom.







ALTERNATIVE SPLICING

Once a chromosome has been sequenced, researchers edit its string of letters into genes. This is no small task: Genes have no fixed length (they may span anywhere from 100 to more than 2 million nucleotides), and it's not obvious where one gene ends and another begins. To identify individual genes, scientists use a combination of computer power and human expertise.

Once scientists identify a gene, they look for the different ways it could be translated into proteins. (It's like trying to read a page of letters without the benefit of spaces or punctuation: The string "letsgotogether" could be translated to "Let's go together" or "Let's go to get her.") This process is known as alternative splicing. In this detail of possible splice variations, the blocks represent exons (bases thought to code for proteins) and the lines represent introns (bases not involved in creating proteins).

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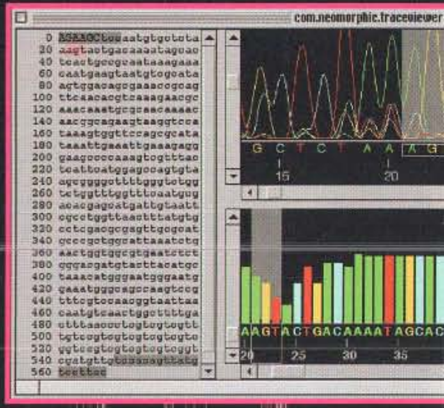
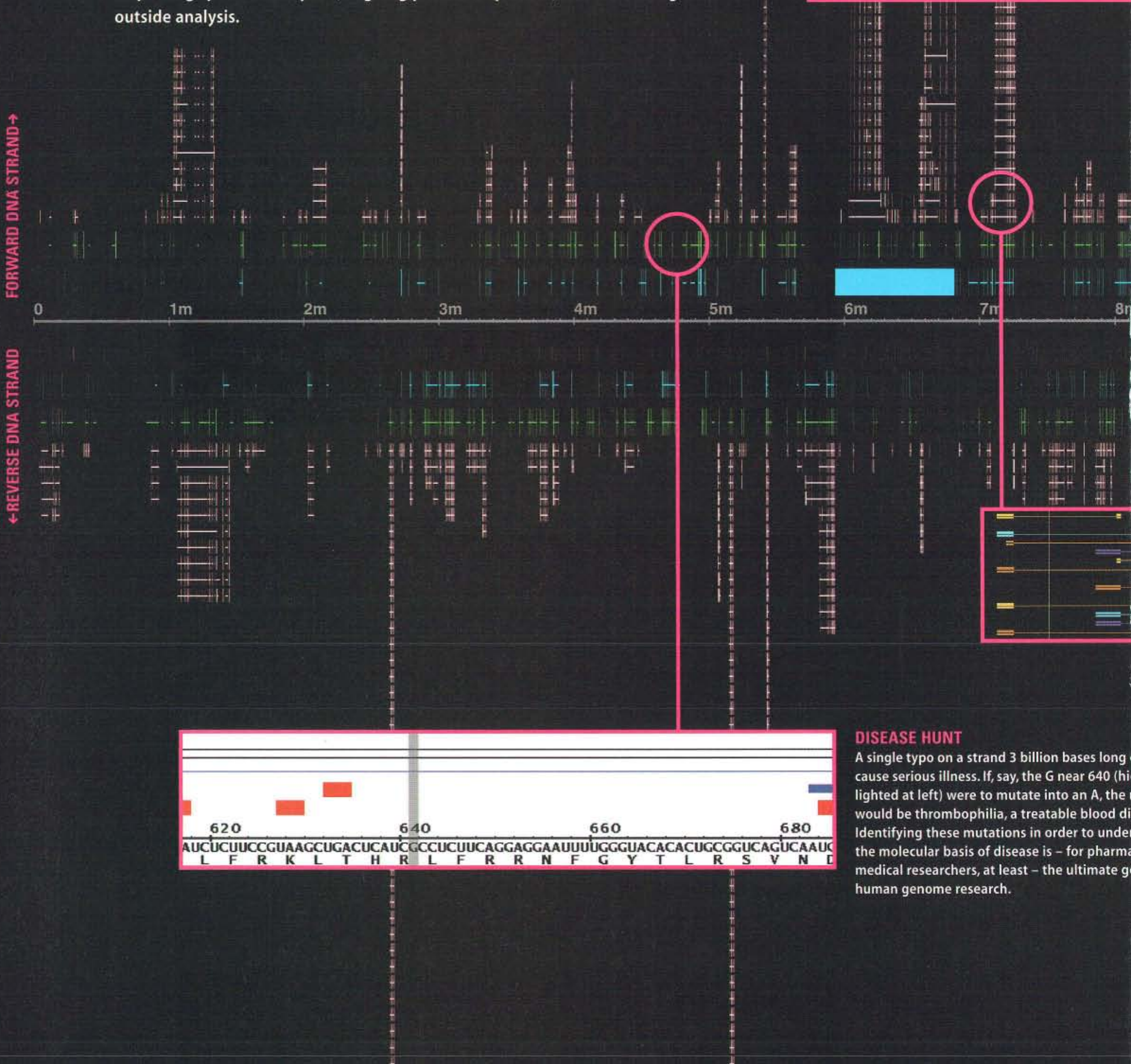
DEOXYRIBONUCLEIC ACID TEST

This satellite view of chromosome 22, courtesy the number-crunching tools of Neomorphic, lays out the chromosome's estimated 34.5 million base pairs along the horizontal gray axis that separates the two strands of the double helix.

Before Neomorphic began its assault on chromosome 22, public genome data included gene predictions by the Human Genome Project (in blue) and single base-pair variations known as "snips" (in yellow) from the National Center for Biotechnology Information. Neomorphic recrunched the data, using statistical analysis to predict the genes shown in green, then layering in lab analysis for those in orange, which show the different ways that a single gene could be translated into proteins. Each of the callout boxes showcases Neomorphic tools at work, breaking out nucleotide traces and filtering out repeats, predicting protein splice variations, inspecting specific base pairs, aligning protein sequences, and annotating with outside analysis.





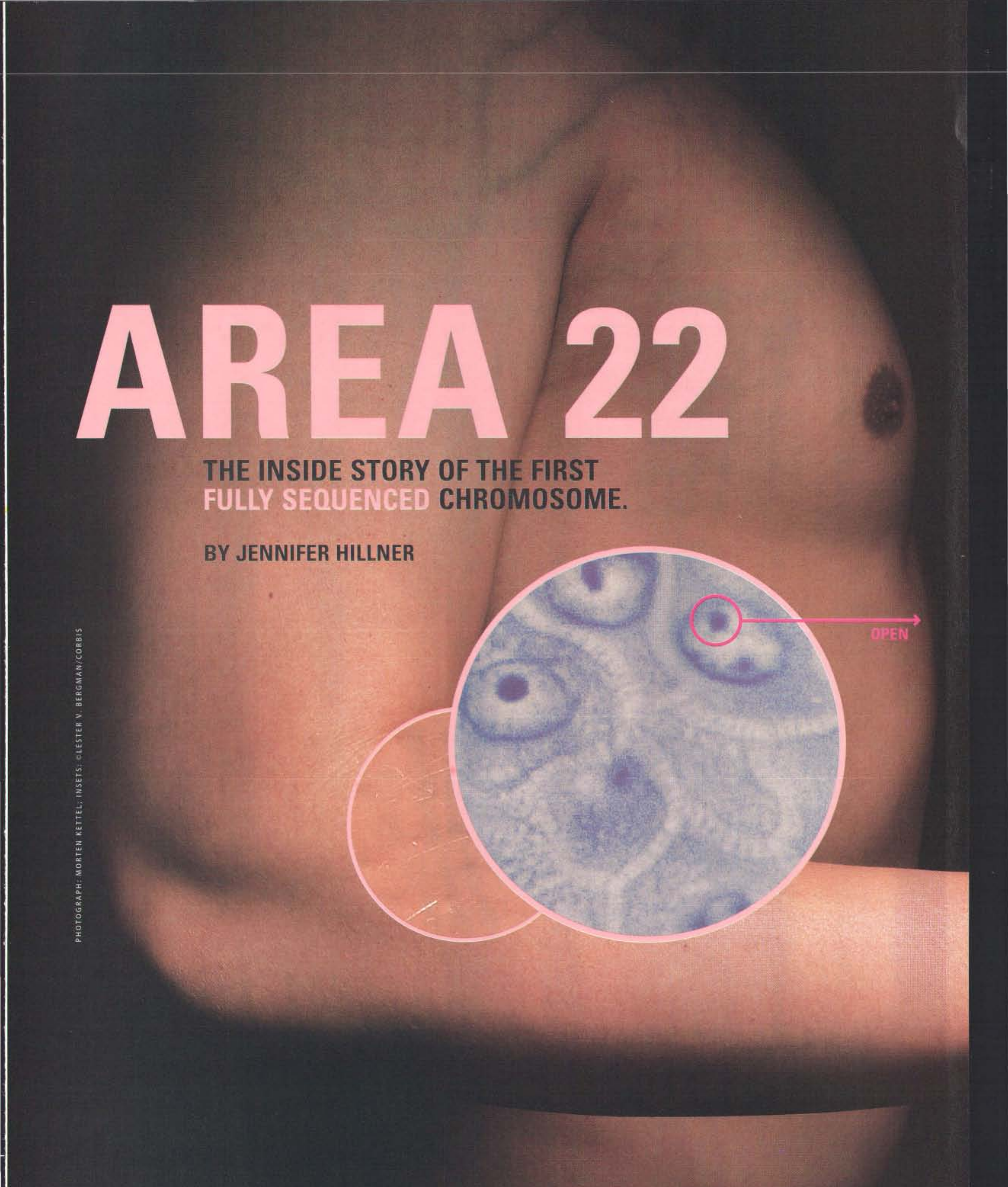
DISEASE HUNT

A single typo on a strand 3 billion bases long
cause serious illness. If, say, the G near 640 (hi
lighted at left) were to mutate into an A, the
would be thrombophilia, a treatable blood di
Identifying these mutations in order to under
the molecular basis of disease is – for pharma
medical researchers, at least – the ultimate g
human genome research.

AREA 22

THE INSIDE STORY OF THE FIRST FULLY SEQUENCED CHROMOSOME.

BY JENNIFER HILLNER



PHOTOGRAPH: MORTEN KETTEL; INSETS: ©LESTER V. BERGMAN/CORBIS

We are crossing the finish line: Sometime this summer, a rough draft of the human genome, sequenced and assembled, will be completed – a map that will show 3 billion nucleotides arranged on 23 pairs of chromosomes.

This seemed like a distant goal just one year ago, but the pace of discovery has taken off, supercharged by millions of dollars in private funding and massive advances in technology, ranging from processing power to high-speed genetic sequencing machines that take in samples of DNA at one end and spit nucleotide code out the other. Public human genome databases now hold 8 billion nucleic acid sequences and are growing at a rate of 1 billion a month. In March, a consortium of public and private research groups revealed the genetic code of *Drosophila melanogaster*, the fruit fly. Then, at a congressional hearing in April, Celera Genomics president Craig Venter announced that his company had completed a rough, unassembled sequencing of the entire human genome. Both Celera and the international Human Genome Project are sprinting to finish the job.

But this achievement marks another beginning – in itself, the assembled sequence means very little. Researchers still don't agree on the exact number of genes it takes to make a human – anywhere from 35,000 to 120,000. In the next decade, as we uncover the subtle details of each strand, we'll discover the full meaning of the human genome, from how we live to how we die. To tease that information out of the terabytes of data, researchers use analytical tools developed by companies such as Berkeley-based Neomorphic (*www.neomorphic.com*), whose sophisticated interface and proprietary gene-hunting algorithms let scientists scan an entire chromosome at once or zoom in to the base-pair level. When a consortium of four Human Genome Project institutes sequenced the second smallest human chromosome last December, researchers counted 545 genes, directly associated with 35 diseases; included were 11 areas that couldn't be deciphered with the available technology. Six months later, Neomorphic recrunched that data and predicted around 1,000 genes, along with their many possible gene splice variants. See for yourself: Chromosome 22 – the first human chromosome to be fully sequenced – appears on the foldout inside, spliced and diced by Neomorphic. The most complete analysis of the best-understood chromosome to date, this map details the front lines of genome research. ■ ■ ■

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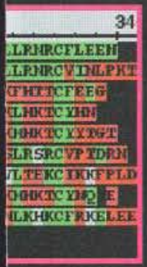
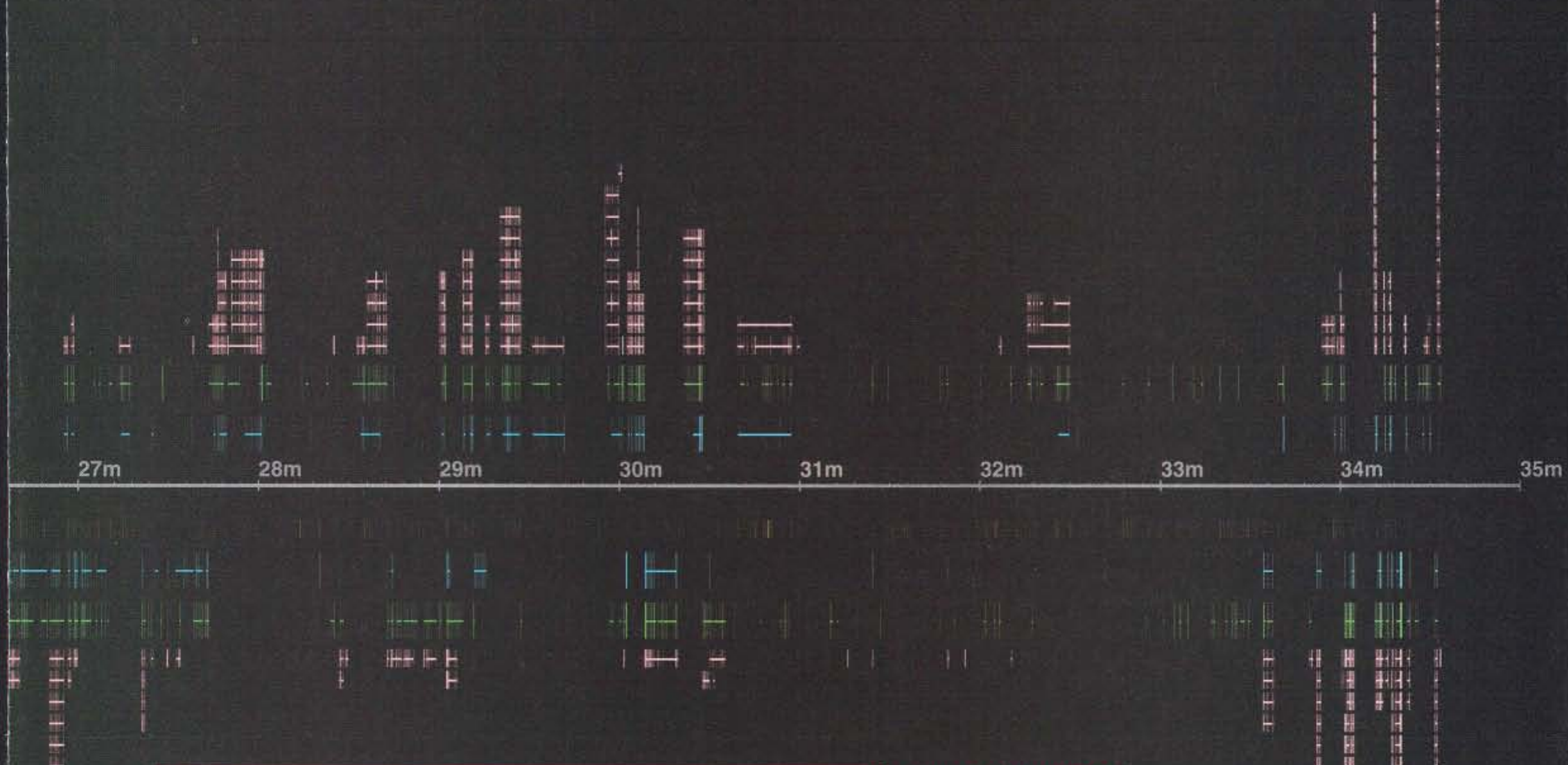
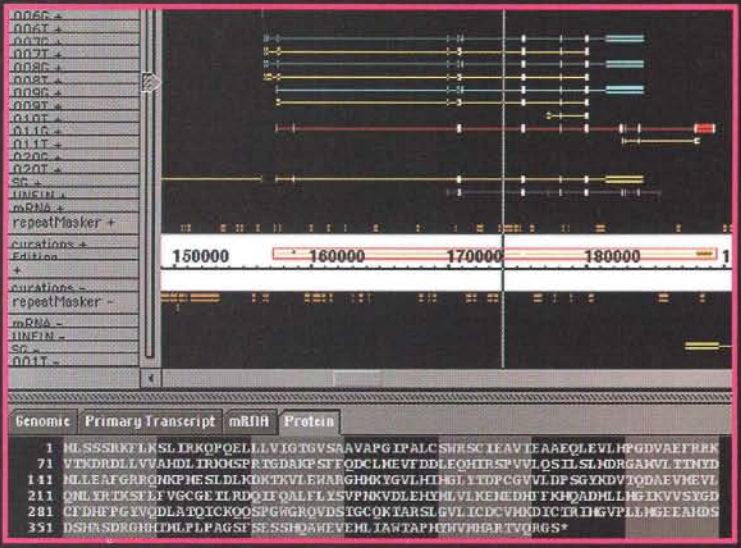


COMPARATIVE GENOMICS

To determine the function of a human gene, scientists look for clues in the genetic makeup of other more-studied species. In the example shown here, a section of a protein coded by a gene found on chromosome 22 is aligned with similar protein sequences from eight different organisms. The similarities (shown in green) indicate that this portion of human gene contains the blueprint for a channel that allows chloride ions to enter and exit the cell. This channel varies from species to species, and these differences (shown here in red) are reflected at the genetic level.





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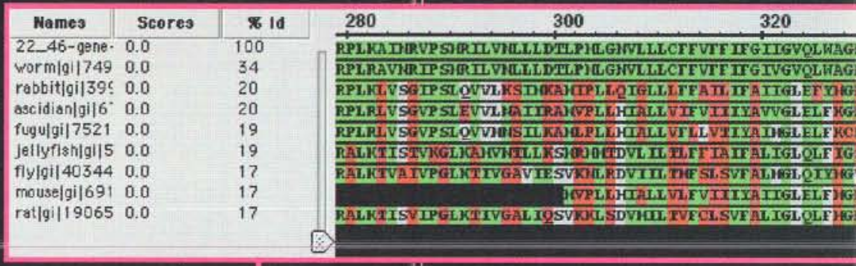
GENOME ANNOTATION

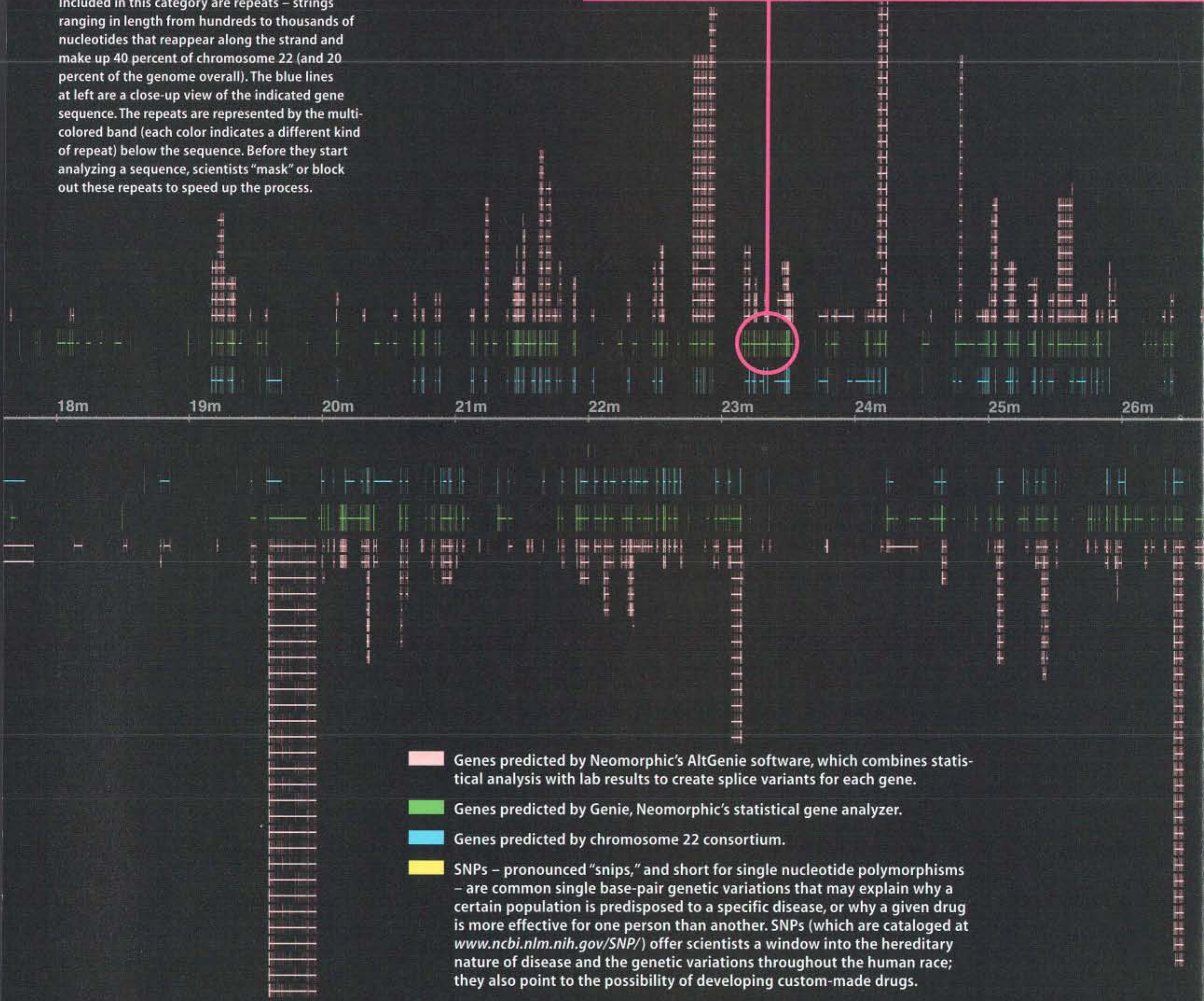
Interpreting the genome is an ongoing, iterative process. To truly understand the function of each gene, scientists combine data from computational analysis of the sequence with lab results in an interactive gene-editing application. In this example, the splice variant shown in red has been copied into the white editing window. As a scientist tweaks the length of a predicted exon or intron, the corresponding changes in the protein sequence appear in the window below. This process allows scientists to add their own logic to the mix, adjusting the computer's analysis in the same way a human translator might edit a document that had been machine-translated. This human interpretation of the genome is the next crucial step. ■ ■ ■

REPEATS

Only about 3 to 5 percent of the genome actually codes for genes. The rest is referred to as junk DNA, though it would be more accurate to say that scientists don't understand what it's doing there. Included in this category are repeats – strings ranging in length from hundreds to thousands of nucleotides that reappear along the strand and make up 40 percent of chromosome 22 (and 20 percent of the genome overall). The blue lines at left are a close-up view of the indicated gene sequence. The repeats are represented by the multicolored band (each color indicates a different kind of repeat) below the sequence. Before they start analyzing a sequence, scientists "mask" or block out these repeats to speed up the process.



Names	Scores	% Id	280 300 320
22_46-gene-	0.0	100	RPLKAIHRVPSHRILVNLLLDTLPHLGNVLLLCFFVFFIFGIIGVQLWAG
worm|gi|749	0.0	34	RPLRAVNRIPSHRILVNLLLDTLPHLGNVLLLCFFVFFIFGIVGVQLWAG
rabbit|gi|39	0.0	20	RPLKLVSGIPSLQVVLKSIHKAHIPLLQIGLLLFFATLIFAIIGLEFYHG
ascidian|gi|6	0.0	20	RPLRLVSGVPSLEVVLHAIIRAHVPLLHIALLVIFVIIIYAVVGLELFKG
fugu|gi|7521	0.0	19	RPLRLVSGVPSLQVVHHSILKAHLPLLHIALLVFLLVTIYAIHGLELFKC
jellyfish|gi|5	0.0	19	RALKTISTVKGLKAHVNTLLKSHRHHTDVLILTLFFIAIFALIGLQLFIG
fly|gi|40344	0.0	17	RALKTVAIVPGLKTIVGAVIESVKHLRDVIILTHFSLSVFALHGLQIYHG
mouse|gi|691	0.0	17	HVPLLHIALLVLFVIIIYAIIGLELFHG
rat|gi|19065	0.0	17	RALKTISVIPGLKTIVGALIQSVKHLSDVHILTVFCLSVFALIGLQLFHG



🟥 Genes predicted by Neomorphic's AltGenie software, which combines statistical analysis with lab results to create splice variants for each gene.

🟩 Genes predicted by Genie, Neomorphic's statistical gene analyzer.

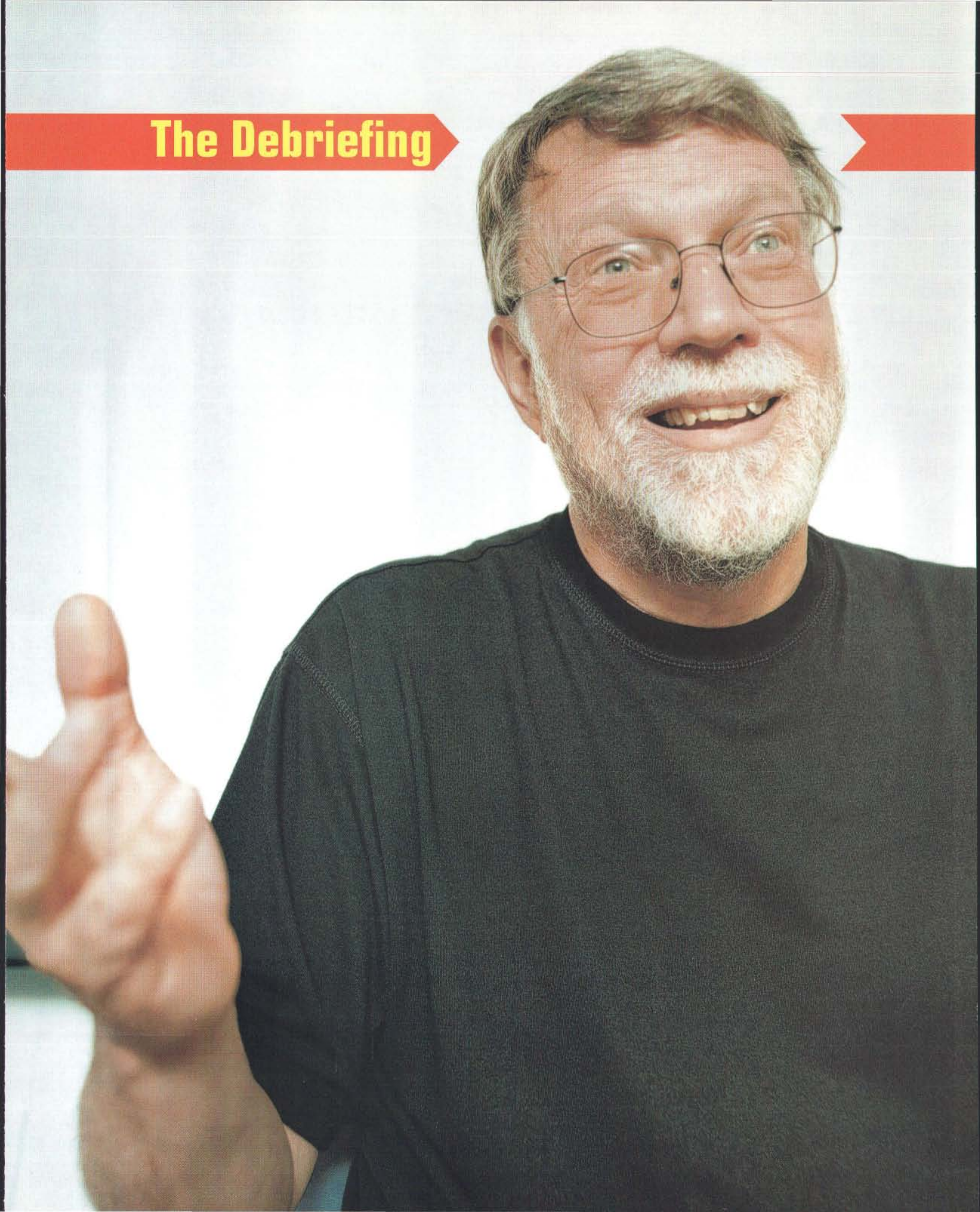
🟦 Genes predicted by chromosome 22 consortium.

🟨 SNPs – pronounced "snips," and short for single nucleotide polymorphisms – are common single base-pair genetic variations that may explain why a certain population is predisposed to a specific disease, or why a given drug is more effective for one person than another. SNPs (which are cataloged at *www.ncbi.nlm.nih.gov/SNP/*) offer scientists a window into the hereditary nature of disease and the genetic variations throughout the human race; they also point to the possibility of developing custom-made drugs.

⬜ The sequence of 34.5 million nucleotides, readable as a string of As, Ts, Cs, and Gs in a magnified view.

Data Sources: The Sanger Centre, *www.sanger.ac.uk/HGP/Chr22/*; Department of Molecular Biology, Keio University School of Medicine, *www.dmb.med.keio.ac.jp*; Department of Chemistry and Biochemistry, University of Oklahoma, *dna1.chem.ou.edu*; Genome Sequencing Center, Washington University School of Medicine, *genome.wustl.edu/gsc/index.shtml*; Neomorphic.

The Debriefing



John Seely Brown

After 10 years at the helm of Xerox PARC, JSB talks about the art of R&D judo, the science of smart stuff, and life beyond the ivory basement.

Interview by Michael Schrage > Photograph by John Clark

"The easiest way to predict the future is to invent it": Alan Kay's phrase became the early-days hallmark of Xerox PARC, when the Palo Alto Research Center famously invented the graphical user interface and the first true personal computer, the Alto. PARC, in effect, predicted the course of the digital revolution. Having invented the future, Xerox then infamously fumbled it, turning over its world-beating tools to two upstarts named Steve Jobs and Bill Gates. This corporate blunder – perhaps the most stunning example of indirection in innovation ever – permanently shifted the competitive and psychological landscape of Silicon Valley. PARC kept pushing the envelope of innovation, creating cool new tools from blue lasers to electronic reusable paper and serving as a launchpad for industry players like Bob Metcalfe and Eric Schmidt.

In recent history, the prolific one-stop shop for tech, talent, and vision has been reinventing the process of invention under the guidance of John Seely Brown. A PARC veteran of 23 years and its director for a decade, Brown, who announced his retirement in June, has relentlessly explored the techniques – not just the technologies – of innovation. In particular, he has focused on how individuals and institutions *really* change, not merely on how they're supposed to. JSB, as he is universally known, was an early leader in encouraging research organizations to pay as much attention to the behavior of complex systems as to the movement of atoms and bits – to recognize, à la the title of his recent book coauthored with Paul Duguid, *The Social Life of Information*.

JSB, who remains chief scientist of the Xerox Corporation and sits on boards ranging from Corning to the CIA venture fund In-Q-Tel, has by no means left the arena of invention, though he disagrees with Alan Kay's mantra. You don't invent the future, says John Seely Brown – you unleash it by leveraging the global community mind. – *Eds.*

Michael Schrage, codirector of the MIT Media Lab's eMarkets Initiative, is the author of Serious Play: How the World's Best Companies Simulate to Innovate.

Wired: Your PARC colleague Mark Weiser used to say, "You let what you build change you, and you move on."

JSB: I ain't moving. I'll stay here in the building, being chief scientist of the corporation, which I have been for eight years anyway. Still, it will be part-time: I want to do a bunch of other things in the Valley.

What's next?

I don't plan to do any one thing – I'm on a number of boards, which is already occupying too much of my time; I just went on the Tech Museum of Innovation board, and I'm helping a couple of e-based companies get off the ground, one new epayment scheme and an e-innovation company.

Looking back at your time at PARC, what's your biggest innovation?

First of all, getting the social-life perspective understood – looking at the dynamics of information and how it takes on meaning in social contexts. Second, systemic MEMS, as in microelectromechanical systems, the ability to build, or grow, or cut new types of materials that are partly computational and partly structural – I like to call this smart stuff. This whole field now feels like the invention of personal computing and supercomputing was in the early '70s.

So what's the smart-stuff equivalent of the mouse?

We have structural beams that can use microscopic signals to actively self-cancel buckling motions and even strengthen their support.

Which would be used for ...?

If you want to build a color printer, for example, you have to maintain very accurate registration for the different color layers; that requires very stiff material; that makes these printers very big, very heavy. Why does that have to be? Why not have a compact, flexible device following the biological model?

I make a joke: If God thought like today's engineer, our head would be a giant block of steel in order to stabilize our eyeballs. But what does God do? He says, "I've got a noisy system here. Can I cancel the noise?" That's God$_1$. Clever God, God$_2$, says, "Well, sure, I could cancel it by a lot of neurological structures and so forth, but can I *use* that noise to good avail?" Lo and behold, our visual system takes these high-frequency vibrations in our eye and does a vernier computation over a random distribution of rods and cones and enables us to resolve distances less than half the diameter of a rod or a cone.

As a kid, a graduate student kid, I came across this and said, Holy shit – are we screwed up in the way we build systems!

What else has got your blood boiling?

Working with Corning, I've gotten more and more engaged in the transparent optical layer of the backbone of the Internet. We are at a key inflection point in terms of transforming the way people engage in leisure time and activity-based learning, and I'm interested in open source applied to content: How do you take all the old films and outtakes and use them as pieces for bricolage, components for other people to create new things? Do you go into the Mbone? We'll see.

First information wanted to be free – now it wants a social life?

Take the World Wide Web. Point-and-click browsers are an extension of the desktop metaphor – a very disorienting metaphor as you surf the world. How do we design ways to stay oriented with the world, so the user gets centered? The best example is the hyperbolic tree browser we built and spun out in a company called Inxight. That's just scratching the surface of the subtle shift from user-centric design to user-centering design.

So how are users centering themselves?

The Internet is a technology that amplifies our ability to borrow what others have done and build on it. In this way open source is a kind of bricolage. If you look at how most systems today get built, they get built not from the ground up but by borrowing fragments of other people's work, cobbling it together, and then looking at what happens.

But isn't this just an extension of the time-tested impulse to "go over the wall"? Hasn't PARC been doing this all along?

First of all, PARC was fundamentally noncollaborative when I first came – there was surprisingly little cross-disciplinary work. There were turf wars, and physicists, for example, weren't allowed to talk with computer scientists, computer scientists never engaged with materials scientists. It started changing when Bill Spencer took over as director, and it's something that I, working with Bill and working after Bill, really drove. To me the white space between fields is obviously the place to explore if you're trying to maximize your chance of inventing something fundamentally new. If you get multiple disciplines together working around the root of a problem, it pulls you out of your own discipline and fuses different points of view that lead to a reframing. By going to the root, you let nature drive you.

On a macro level, what's the greatest challenge in tech research?

How do you let the world do more of the work for you, with what I think of as judo, by interpreting invisible physical and social forces and leveraging them rather than fighting them. When I was a purebred computer scientist, we were taught early on to take the problem out of context and represent it, compute on it, and put it back into context. So knowledge representation, data structures, algorithms were the sole coin of the day. Now, you can let the world do more of the work. Good architects constantly figure out how to turn constraints inside out, transforming them into resources. With smart stuff, you let the physics of the situation do some of the computing.

An example?

For high-speed color laser printing, we wanted to create a new kind of optical system for spraying light on a photoreceptor belt: We're talking 14,000 vertical-cavity lasers on a surface a quarter the size of my thumb, and on top of each laser a microscopic lens to steer the beam. How do we build lenses smaller than the diameter of a human hair? Not grind them. Not grow crystals. Turns out, some kid walks in and says, "Heat the sucker." Wham-o. It melts; surface tension forms the lens we need. Wonderfully simple. Read the forces of the world in a way that allows you to work with them while respecting the properties that work against you.

> **"Read the forces of the world in a way that allows you to work with them, like judo, while respecting the properties that work against you. Wham-o."**

You've likewise converted social constraints into social resources.

We wanted to train field technicians with AI performance diagnostic tools to be better troubleshooters. Here's what happened: When the going gets rough, tech reps come together and spin a story about their experiments with a machine, remembering some fragment of a story one either has heard or has told himself, weaving together a narrative from these fragments of past stories. The incredibly sophisticated AI technology we invented? Two-way radios that were always on. The reps became this community of practice, always hearing each other. So we use it as a way to break in new technicians. They can lurk.

Lurking is a *pro*social activity?

Absolutely. *Lurk* is the cognitive apprenticeship term for legitimate peripheral participation. The culture of the Internet allows you to link, lurk, and learn. Once you lurk you can pick up the genre of that community, and you can move from the periphery to the center safely asking a question – sometimes more safely virtually than physically – and then back out again. It has provided a platform for perhaps the most successful form of learning that civilization has ever seen. We may now be in a position to really leverage the community mind.

Is that another way of saying open source?

Open source is about creating "literacy." Successful open source creates communities that are literate in understanding the dynamics of what code can or cannot do, global communities that can create standards with minimal elegance. Consider Linux, IETF, or even the original MOSIS system for bootstrapping the community about VLSI design. Open source may also give us a way to crack the robustness problems of really complex systems. In Linux, for example, you write code to be read by others as well as executed by the computer. Writing code to be read is a great form of community hygiene. And when code is meant to be read by others, it has its own social life – it gets picked up by the community and used in all kinds of new ways. Pretty soon the community mind becomes a new kind of platform for innovation.

How do you change the community mind inside Xerox?

A typical example: How do we get the center of the corporation to appreciate an idea? If I go to one of our largest customers, sell them on this idea so they start calling up the head of the corporation saying, "This is what I want, why aren't you producing it for us?" you've taken the force of a gigantic customer and turned it to your avail. That's how we've gotten some of our most successful innovations out.

So you've added new nodes to the network, following Metcalfe's law?

Bob Metcalfe has it all wrong: The power of a network isn't the square of the number of people – it's the number of communities it supports. If you look at n people, there are potentially 2^n communities, the number of subsets there are to a set of n elements. You're going to find these communities of interest emerging worldwide for all kinds of reasons, the cross-fertilization of people in different types of research centers, universities, companies, factory floors - anywhere things are getting discovered, they get aggregated into communities of interest.

What's the biggest shift in how corporations do R&D today?

There's a fundamental change from finding ways to innovate inside a corporation to leveraging the knowledge ecologies of many little companies in places like Silicon Valley. You find that the shift turns much of the classical R&D into A&D - that is, acquisition and development. Larger companies can buy the research they need and instantly acquire a diverse portfolio of research groups.

Why would a brilliant young researcher want to work at PARC?

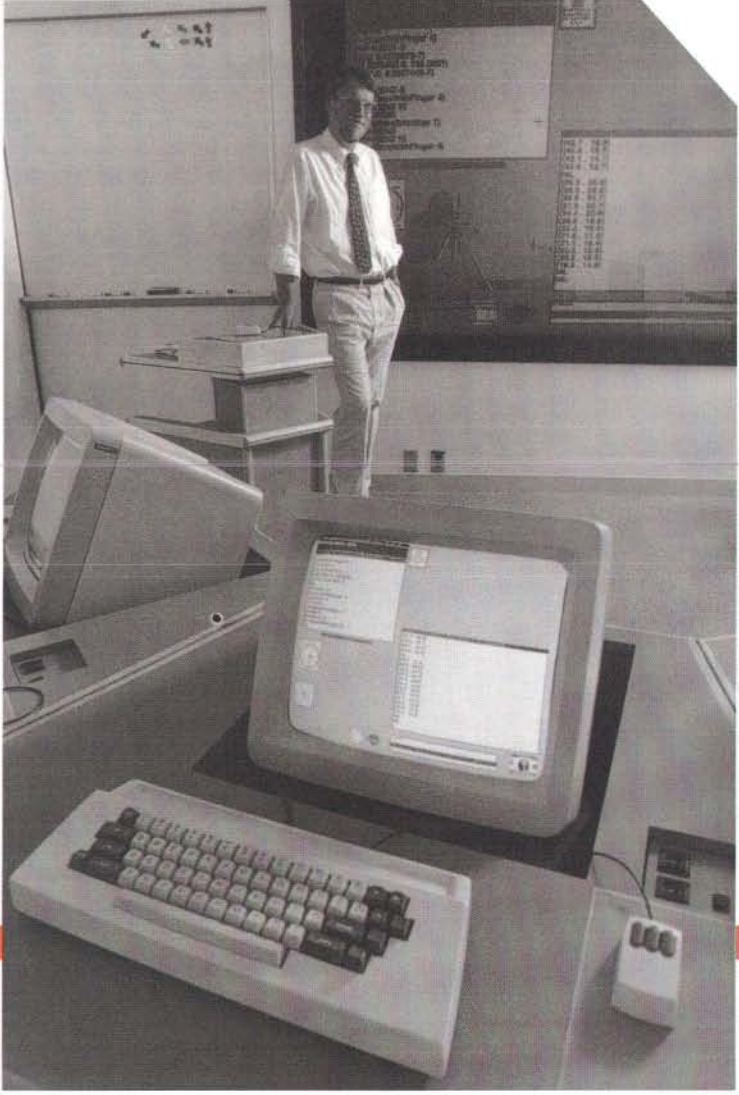
To have lasting impact. If you want short-term impact, a startup may be better. But if you want to do something that transforms an awful lot about how the world gets seen, this place sets the stage.

Is it painful grappling with the market realities when what you really want to do is pursue R&D?

Modern-day research traffics deeply in business dynamics and financial issues, in all the ideas of venture capital and ebusiness. No longer is this an ivory basement, let alone an ivory tower.

Any advice for your successor about life outside the basement?

People keep asking, Are we technology pushers or market pullers? That's a meaningless question today. Get deeply engaged with the shaping of corporate strategy and use it as a way to shape research strategy - that's how to get a high bandwidth of communication.



JSB in PARC's collaborative work environment, aka Colab, in 1984.

What's your role moving forward as chief scientist?

Help do corporate strategy, help look for the big breakthroughs, help craft and maintain an evergreen communication channel with the top of the house.

Any sort of social responsibility?

Personally I think we have to stop pushing technology for technology's sake and start asking serious questions about the social consequences. Technology is moving ahead faster and faster. How do we guarantee a broad enough bandwidth of communication between society and technology so this coevolutionary system stays in balance? One way is to educate the public much more. We may need to invent fundamentally new kinds of institutional regimes that help mediate this chasm.

Such as?

The ACLU a long long long time ago. We forget that at the turn of the century when the industrial revolution was taking off, all kinds of new institutions came into being to help bridge the gap between the power class and the working class, if you wish. Now we're going to see the same thing happen. Having played with the Open Source Foundation, I also have things like IETF and ICANN in mind; but you see the Berkman Center for Internet & Society at Harvard, Larry Lessig's going to create something out here at Stanford - these institutions will help foster public understanding and public debate.

Personally, do you surround yourself with extreme gadgets?

Well, I consider paper an extreme form of technology - I have lots of books. Having broadband communication that is easily channelizable is about all we do in our house - it's ultralow tech.

But don't you have a thing for high-performance vehicles?

That fits into the view of smart stuff. Today's automobile has more computation in it than your office does - computational suspension systems, steering systems, brake systems. I went back to motorcycles because the high-performance motorcycles now have ABS brake systems, which in a panic situation keep you better connected to the road. I bought back some of the reaction time I had lost growing archaic.

What kind of bikes?

I drive BMW motorcycles - have my entire life, for 30 years. Just finished a trip across the country on the new one, a BMW R1100 RS.

Wasn't this a kind of research as well?

Well, the trip was from Xerox headquarters in Stamford, Connecticut, to my house in Palo Alto; I set out with a top Xerox executive on identical BMW R1100 RSs, so we'd run out of gas at the exact same moment and so on - the point was, could we cross the country on just back roads that were marked scenic by the Rand McNally map.

Of the 7,500 miles it took to make it across, 7,000 were scenic roads - of course, it wasn't mathematically optimized.

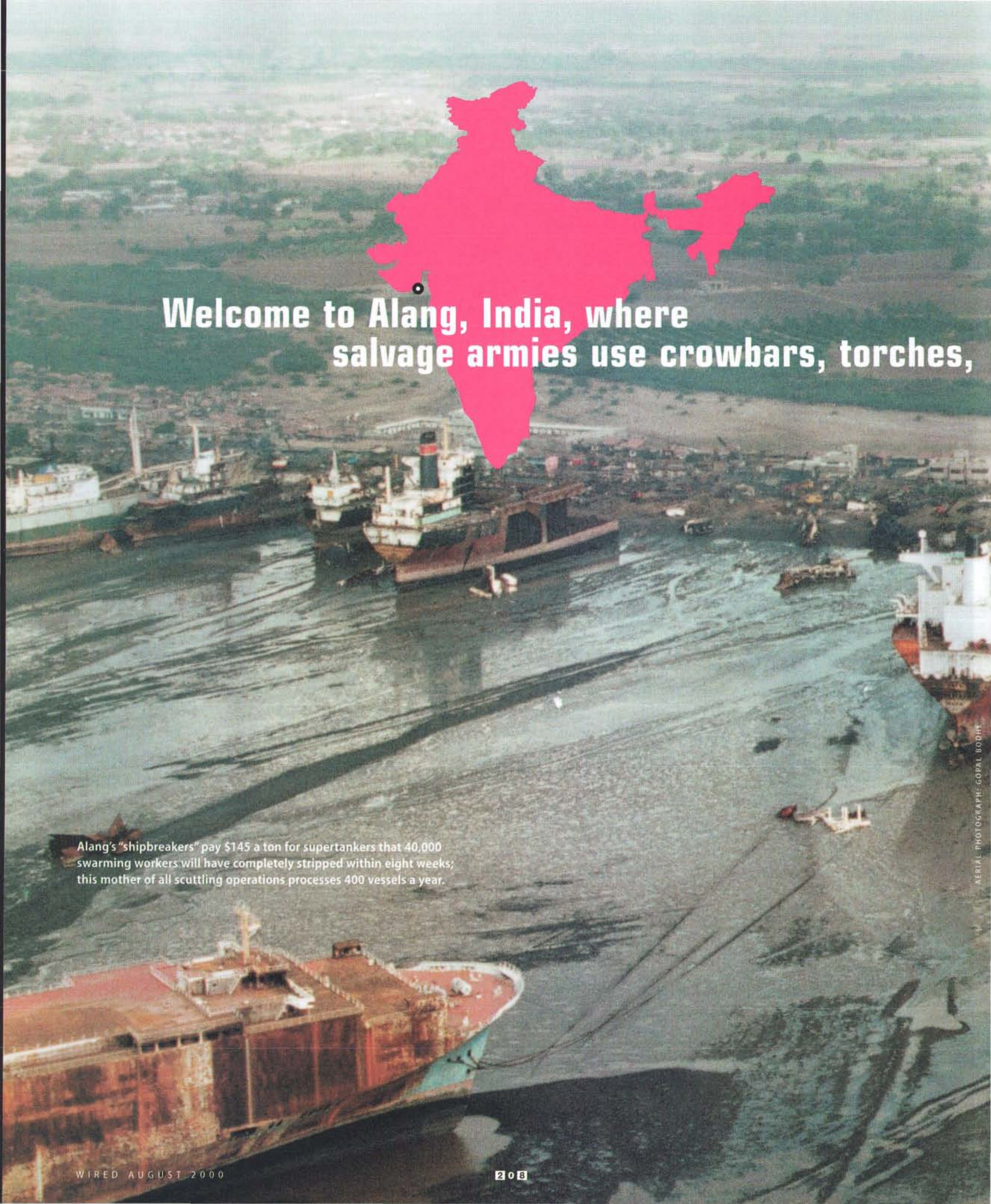
What's the key to research today?

Tools now drive science. Not theory, not experiment - tools have completely changed the speed and nature of innovation. And they have transformed by orders of magnitude the questions we can ask and answer. We now have the ability to have fast, lasting impact.

What gets you more excited, knowing you can find a charismatic young leader or a charismatic young tool?

If you forced me to choose, in today's world, I would go for charismatic tools. But the real key is how to create a charismatic milieu that combines leading-edge designers with leading-edge tools. ■ ■ ■

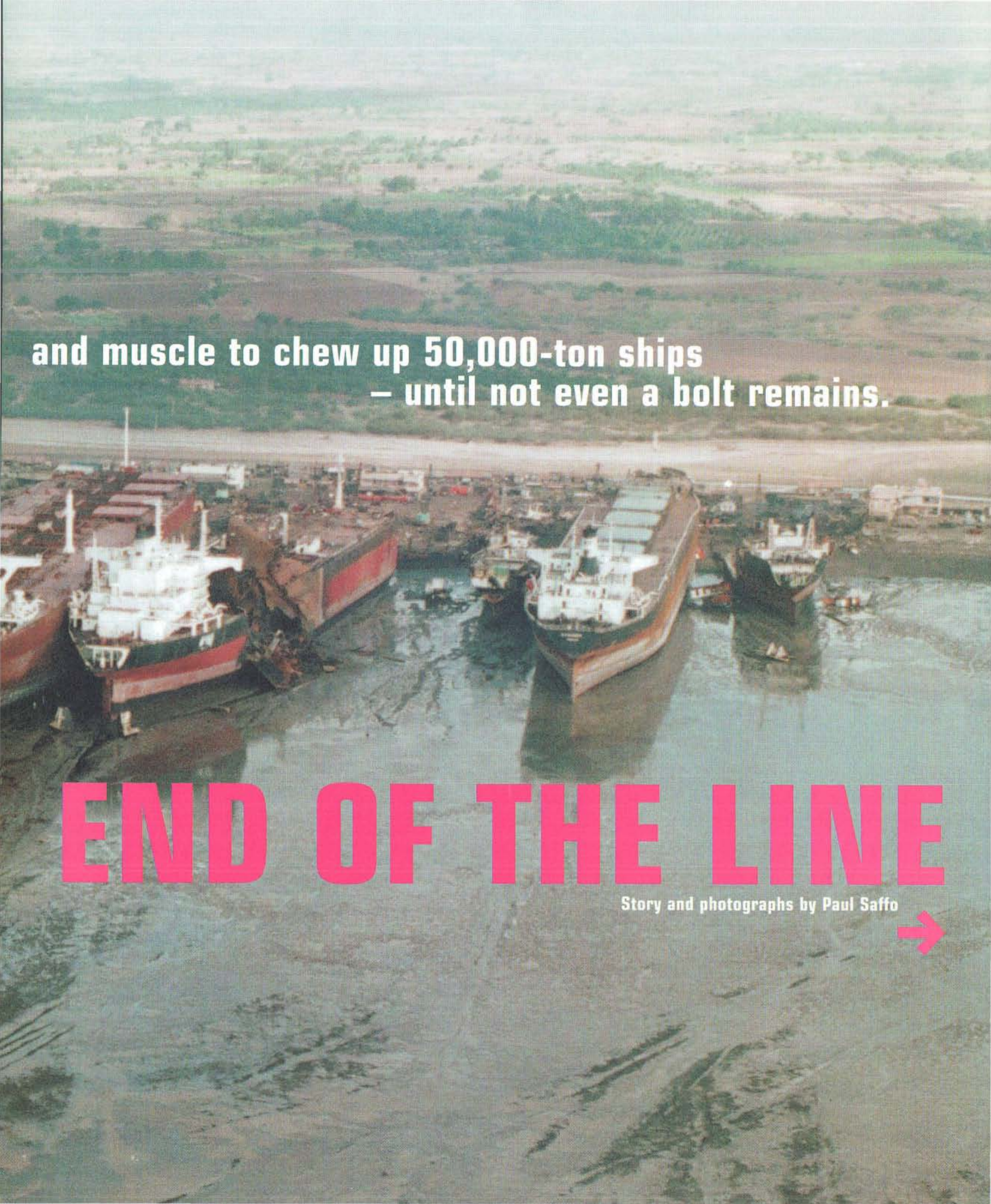
PHOTOGRAPH: BRIAN TRAMONTANA



Welcome to Alang, India, where salvage armies use crowbars, torches,

Alang's "shipbreakers" pay $145 a ton for supertankers that 40,000 swarming workers will have completely stripped within eight weeks; this mother of all scuttling operations processes 400 vessels a year.

AERIAL PHOTOGRAPH: GOPAL BODHE



and muscle to chew up 50,000-ton ships – until not even a bolt remains.

END OF THE LINE

Story and photographs by Paul Saffo

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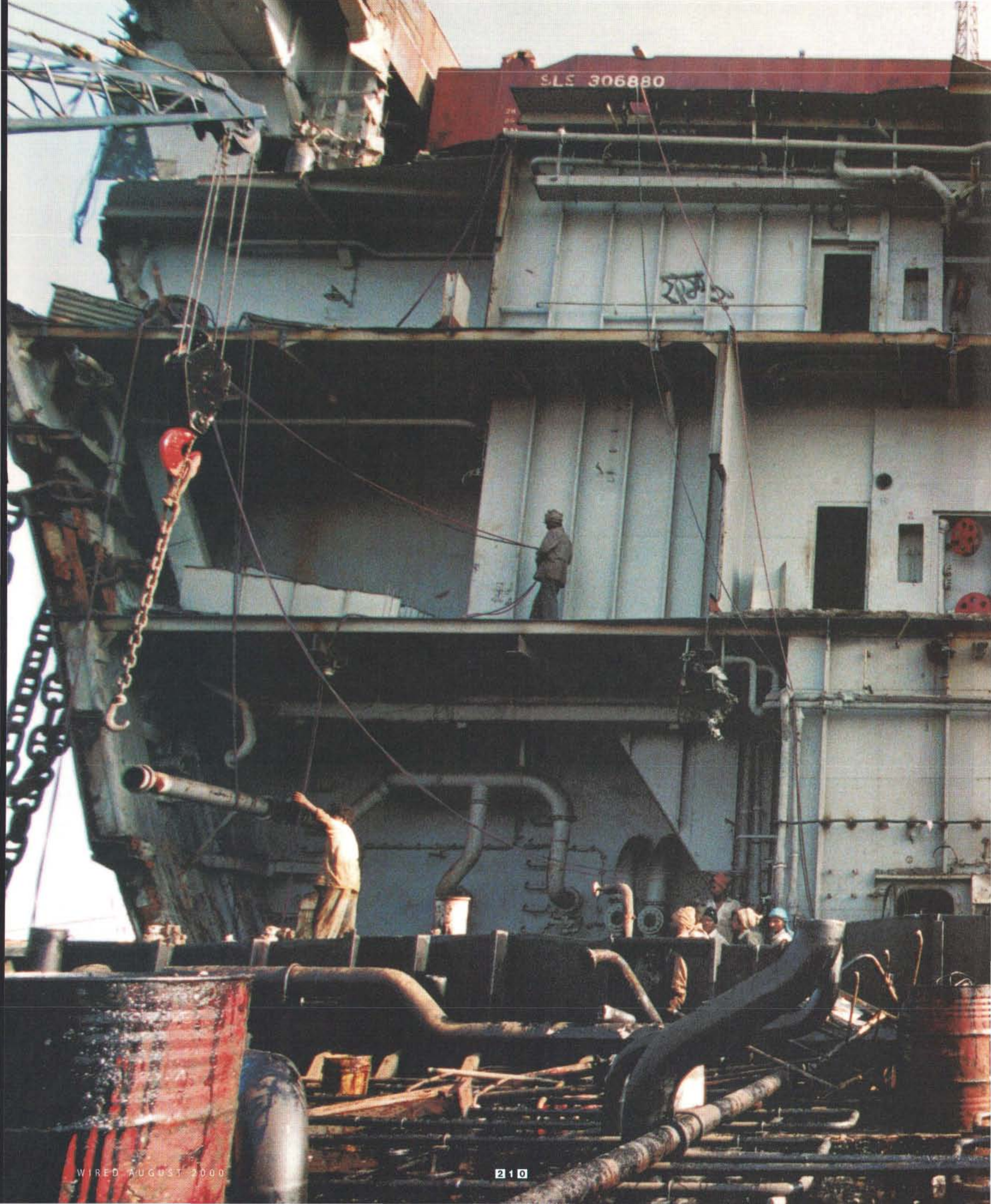
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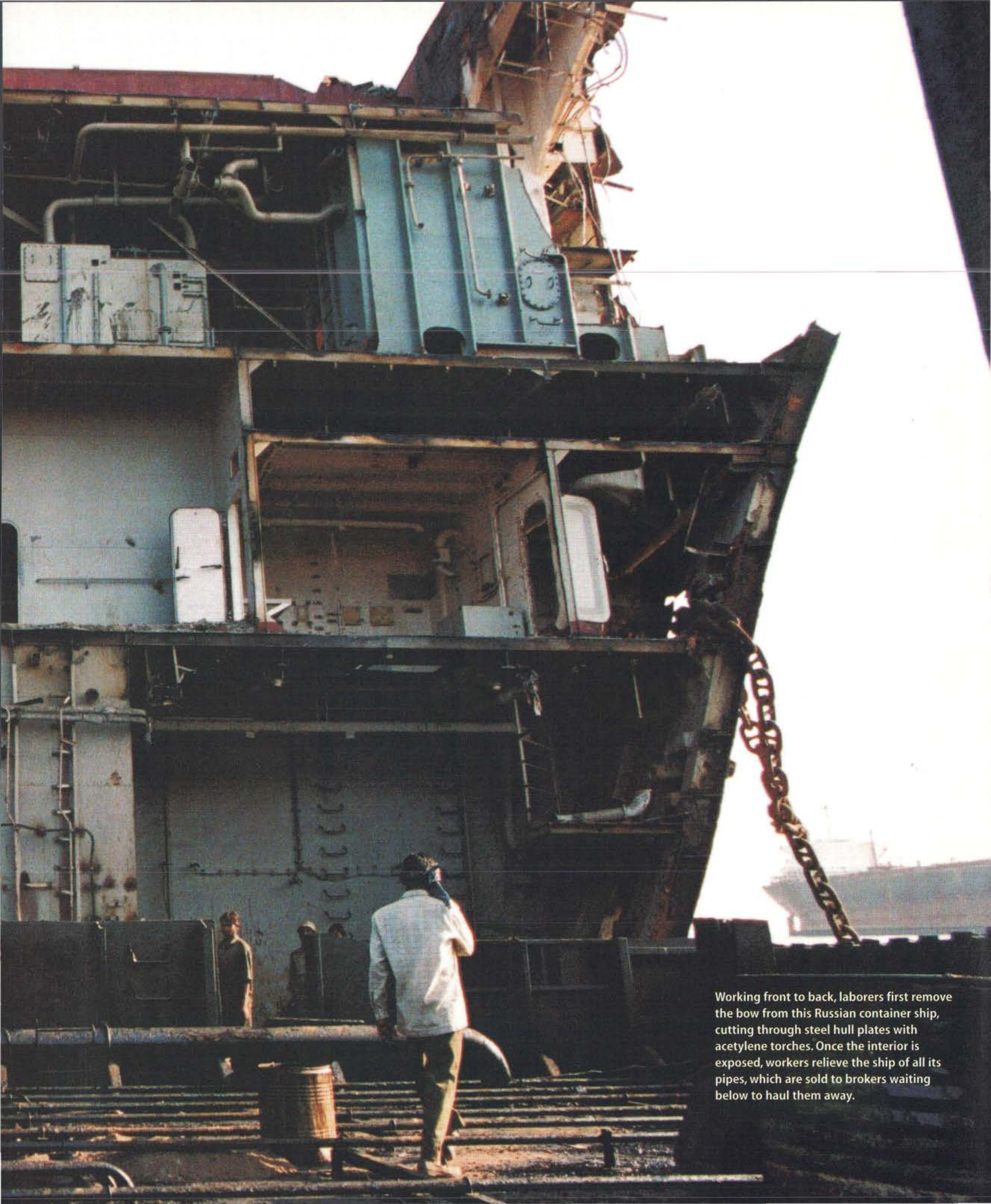
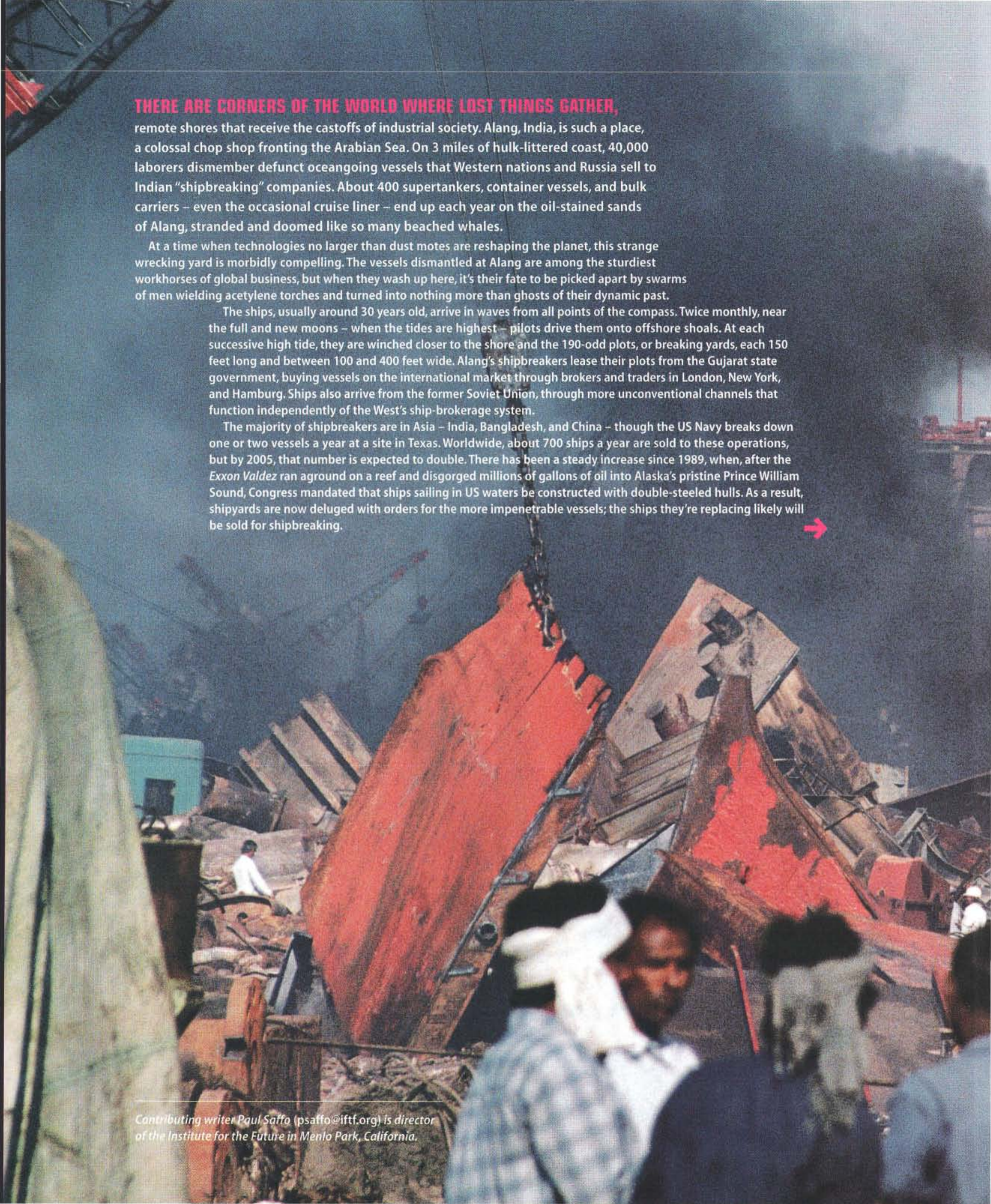


Working front to back, laborers first remove the bow from this Russian container ship, cutting through steel hull plates with acetylene torches. Once the interior is exposed, workers relieve the ship of all its pipes, which are sold to brokers waiting below to haul them away.



THERE ARE CORNERS OF THE WORLD WHERE LOST THINGS GATHER, remote shores that receive the castoffs of industrial society. Alang, India, is such a place, a colossal chop shop fronting the Arabian Sea. On 3 miles of hulk-littered coast, 40,000 laborers dismember defunct oceangoing vessels that Western nations and Russia sell to Indian "shipbreaking" companies. About 400 supertankers, container vessels, and bulk carriers – even the occasional cruise liner – end up each year on the oil-stained sands of Alang, stranded and doomed like so many beached whales.

At a time when technologies no larger than dust motes are reshaping the planet, this strange wrecking yard is morbidly compelling. The vessels dismantled at Alang are among the sturdiest workhorses of global business, but when they wash up here, it's their fate to be picked apart by swarms of men wielding acetylene torches and turned into nothing more than ghosts of their dynamic past.

The ships, usually around 30 years old, arrive in waves from all points of the compass. Twice monthly, near the full and new moons – when the tides are highest – pilots drive them onto offshore shoals. At each successive high tide, they are winched closer to the shore and the 190-odd plots, or breaking yards, each 150 feet long and between 100 and 400 feet wide. Alang's shipbreakers lease their plots from the Gujarat state government, buying vessels on the international market through brokers and traders in London, New York, and Hamburg. Ships also arrive from the former Soviet Union, through more unconventional channels that function independently of the West's ship-brokerage system.

The majority of shipbreakers are in Asia – India, Bangladesh, and China – though the US Navy breaks down one or two vessels a year at a site in Texas. Worldwide, about 700 ships a year are sold to these operations, but by 2005, that number is expected to double. There has been a steady increase since 1989, when, after the *Exxon Valdez* ran aground on a reef and disgorged millions of gallons of oil into Alaska's pristine Prince William Sound, Congress mandated that ships sailing in US waters be constructed with double-steeled hulls. As a result, shipyards are now deluged with orders for the more impenetrable vessels; the ships they're replacing likely will be sold for shipbreaking.

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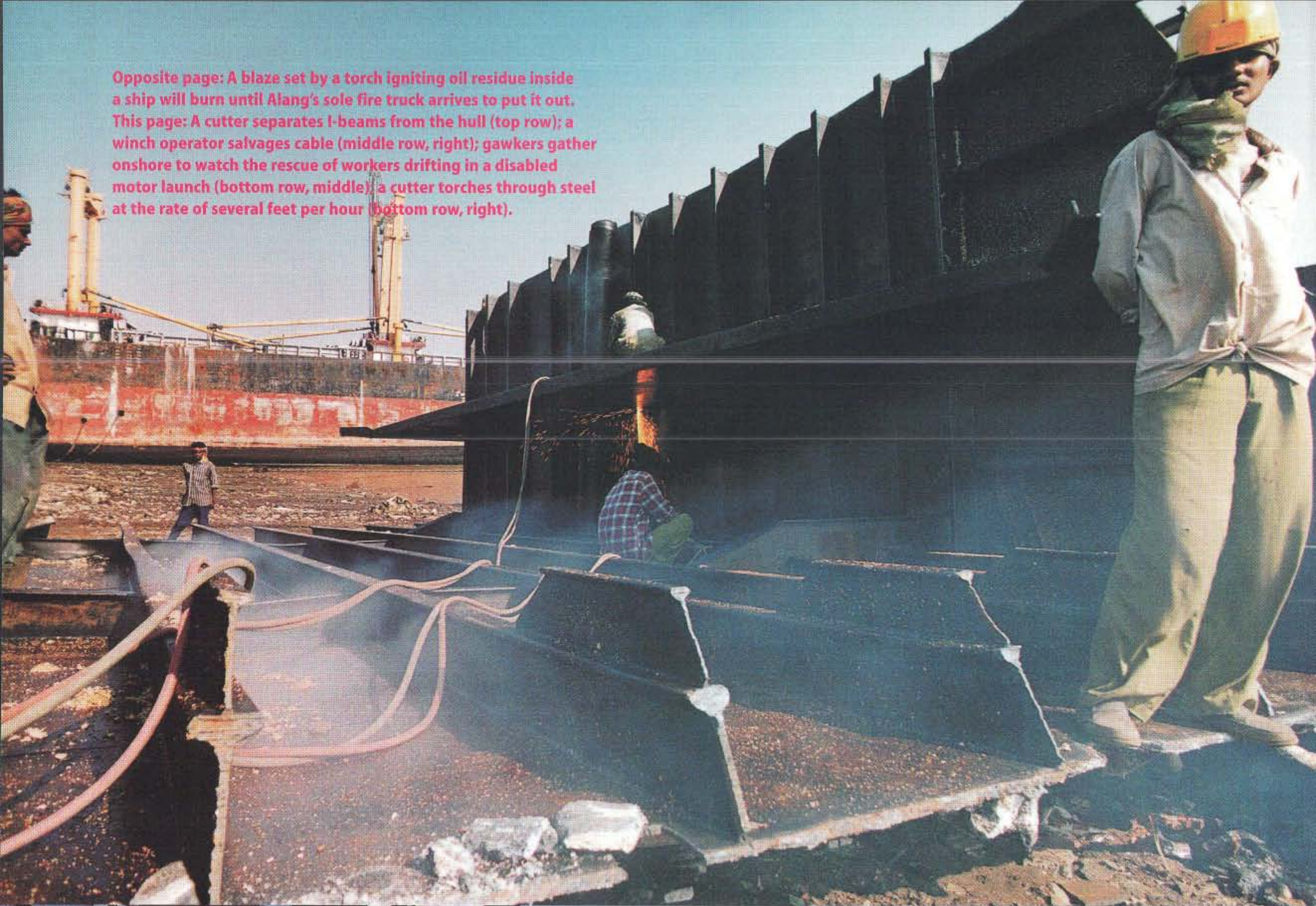
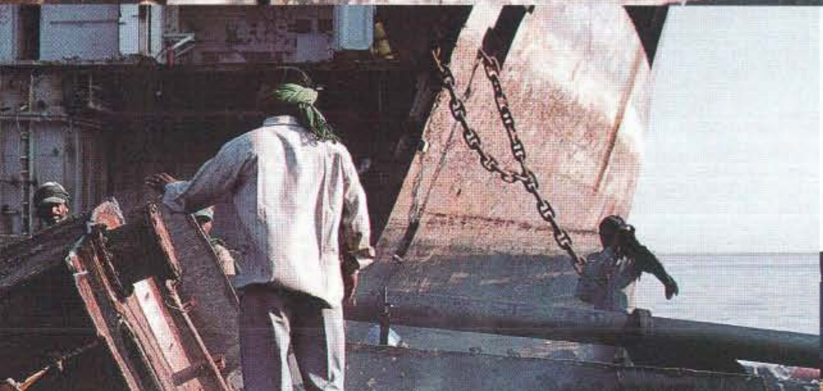
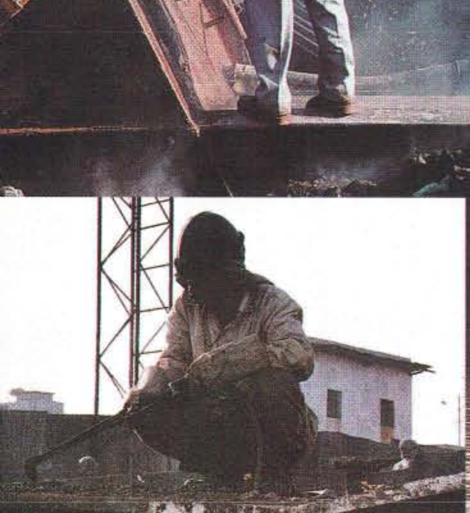
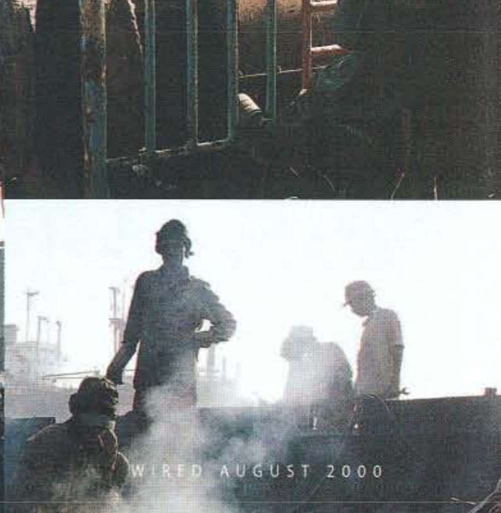
Contributing writer Paul Saffo (psaffo@iftf.org) *is director of the Institute for the Future in Menlo Park, California.*

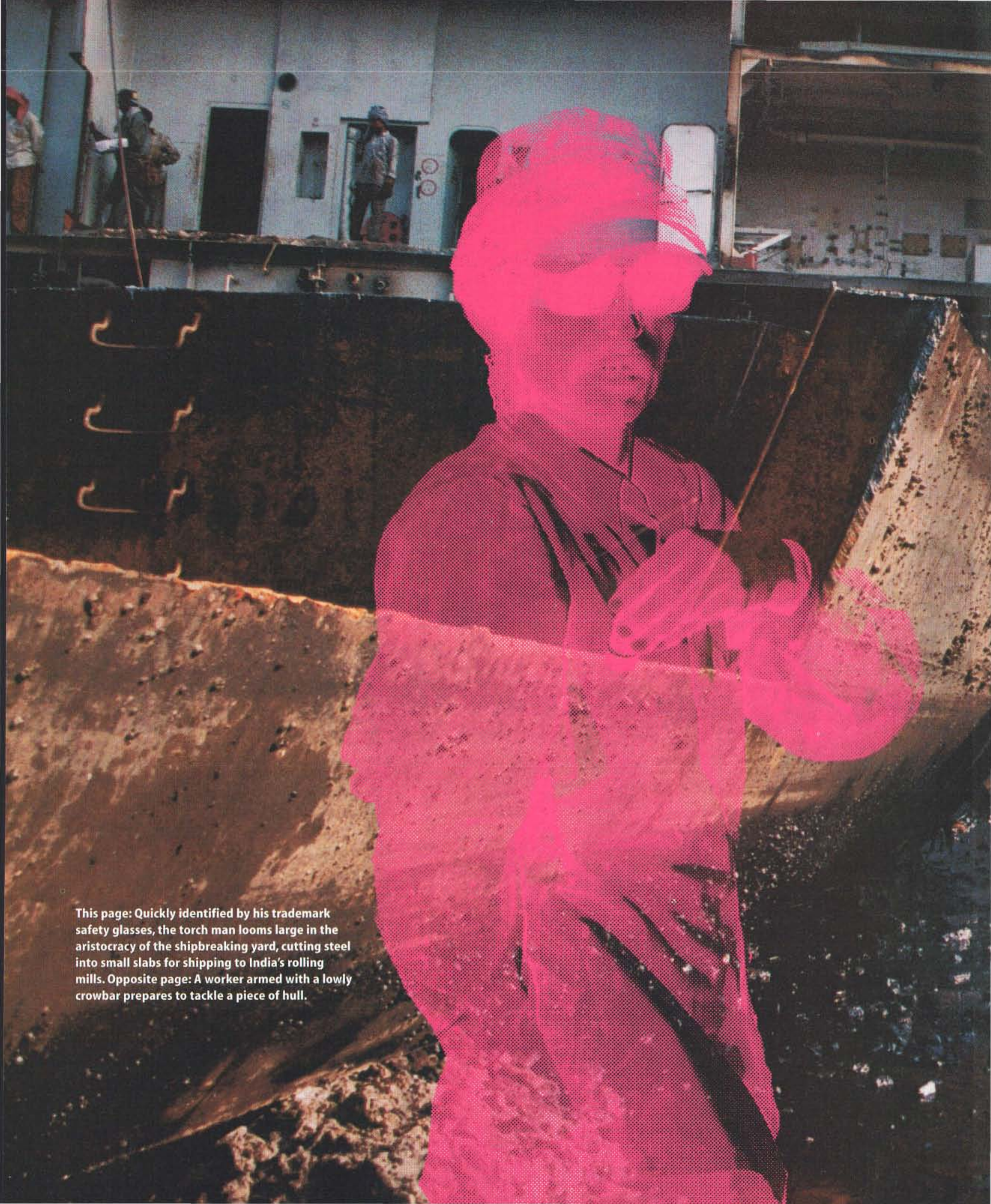
Opposite page: A blaze set by a torch igniting oil residue inside a ship will burn until Alang's sole fire truck arrives to put it out. This page: A cutter separates I-beams from the hull (top row); a winch operator salvages cable (middle row, right); gawkers gather onshore to watch the rescue of workers drifting in a disabled motor launch (bottom row, middle); a cutter torches through steel at the rate of several feet per hour (bottom row, right).











This page: Quickly identified by his trademark safety glasses, the torch man looms large in the aristocracy of the shipbreaking yard, cutting steel into small slabs for shipping to India's rolling mills. Opposite page: A worker armed with a lowly crowbar prepares to tackle a piece of hull.

ALANG'S PROFIT MARGINS ARE RAZOR-THIN, so plot owners have become adept at squeezing every last rupee from their businesses. Shipbreakers buy a 52,000-ton supertanker for about $7.5 million – $145 per ton. In a typical year, the Alang shipbreakers collectively buy $500 million worth of old ships and sell the parts for $700 million. The profit and loss on individual ships can vary widely – some ships are harder to cut up than others, and it's quite possible to lose money on a particular ship if it consumes an unexpectedly large number of man-hours.

Because the plot owners recover their investment only as quickly as they can sell the metal, there's strong incentive for speed. Within four weeks of arriving at Alang, a 700-foot oil tanker will be reduced by a third; within eight weeks, not so much as a bolt will be left on the sand. Once severed from the ship, slabs of metal are systematically cut down into ever smaller and more uniform chunks, which are loaded onto trucks departing nightly for rolling mills and foundries all over India. One day last December, I looked on as a worker burned through a stanchion holding the bulkhead of a 1980s-vintage Russian container vessel. I'll never know which ship it was; by the time I arrived, the bow bearing the vessel's name was long gone. Using little more than torches and crowbars, the cutters swiftly went to work on the rest of the ship, slicing out huge chunks to be lifted shoreside by cranes.

From such a ship, about 13,200 tons of steel (hull, diesel engine, anchor and chain, steam plant, and so on) are recycled and sold. About 100,000 feet of pipe are recovered and recycled, as well as the ship's hydraulic system; its 35-ton propeller of brass-manganese alloy; faucets, mattresses, refrigerators, and cutlery; and every scrap of rubber, glass, plastic, and wood. Inside the ship's condenser, about 5 feet tall and 6 feet long, are 5,000 brass rods. The workers clean each rod by hand, then put them into bundles of 10 to sell to Indian brass dealers.

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THE POLLUTION GENERATED BY THE WORK AT ALANG IS INESCAPABLE: The air is thick with the smell of ozone, tar balls bob in the sluggish water. Each ship that arrives is a problem exported from the developed world – older vessels, in particular, harbor asbestos, PCBs, and dioxins, as well as heavy metals and hydrocarbons. Both Indian and international law require sellers to remove hazardous materials from the ships, but even a casual glance at the wrecks on the beach suggests that at least some of the sellers ignore their responsibilities.

It's tempting to condemn the spectacle at Alang, and many do. On the day I was there, a Greenpeace Zodiac raft bearing a NO TOXIC DEATHSHIPS banner was crisscrossing the waters a mile or so offshore. But the situation here illustrates the complex realities of a third world economy that exists to deal with the industrialized world's castoffs. Alang is the rock bottom of one resource chain, but it is the starting point for another, vital supply line. The steel recovered on this beach is, after all, being recycled, and that translates into affordable resources.

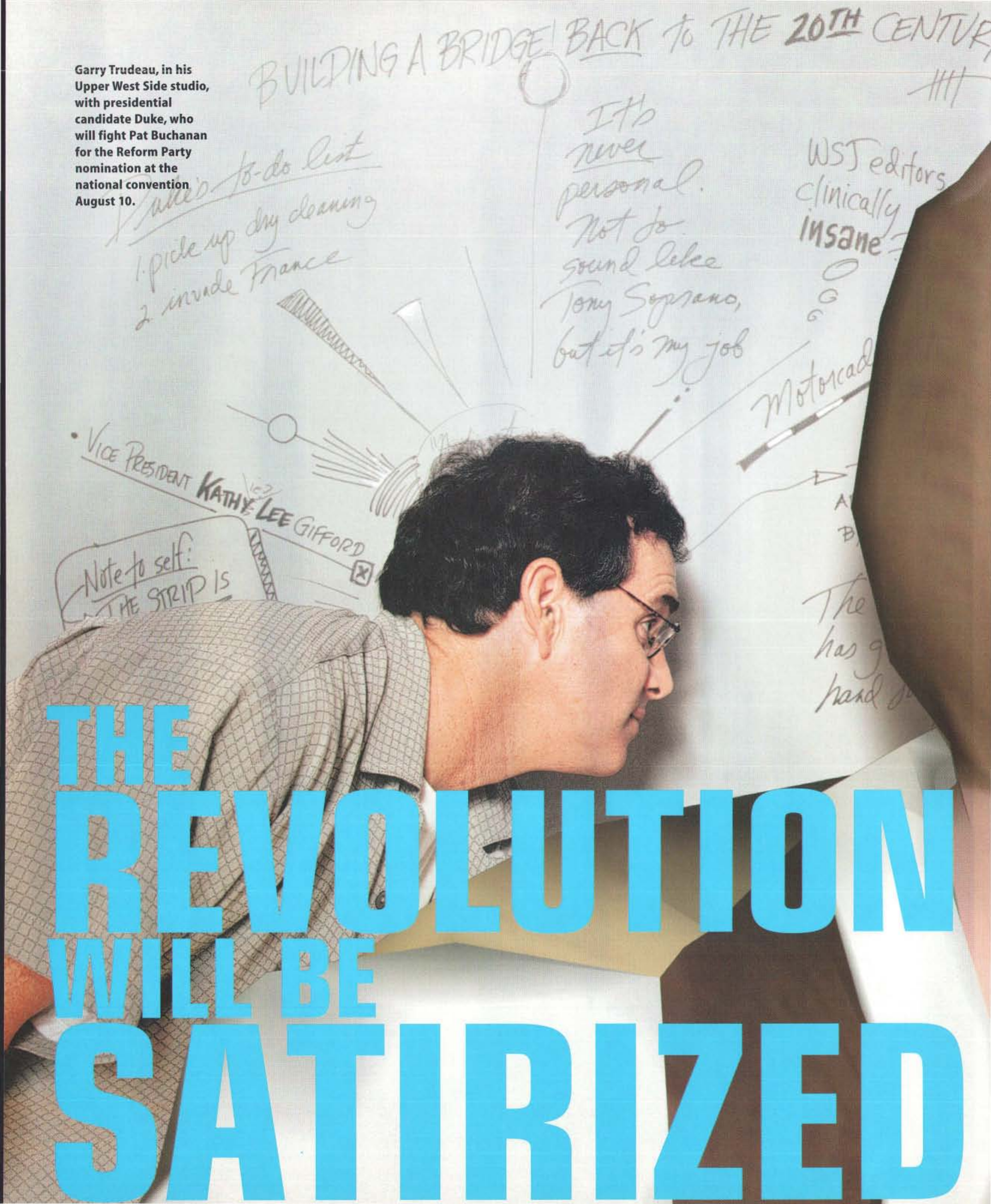
Labor conditions at Alang are grim. A 7-to-7 workday is enforced, wages run about 8 cents an hour, and accidents are frequent and deadly – between 300 and 400 workers at Alang perish every year, giving rise to a macabre saying among the men who do the heavy lifting: "A ship a day, a death a day." But for the back-country villagers who cross half the Indian subcontinent to work here, the alternative is unemployment.

The shipbreakers' association that oversees Alang has become painfully aware of its safety deficiencies and the West's disapproval of them. In 1998 a team from the *Baltimore Sun* won a Pulitzer prize for a scathing series on the environmental and labor hazards at Alang. Yet the current harsh economic reality is that if Alang adds safety measures that erode its tenuous profit margins, the ships will simply get dismantled somewhere else, probably by shipbreakers in Bangladesh, where environmental and working conditions are even worse.

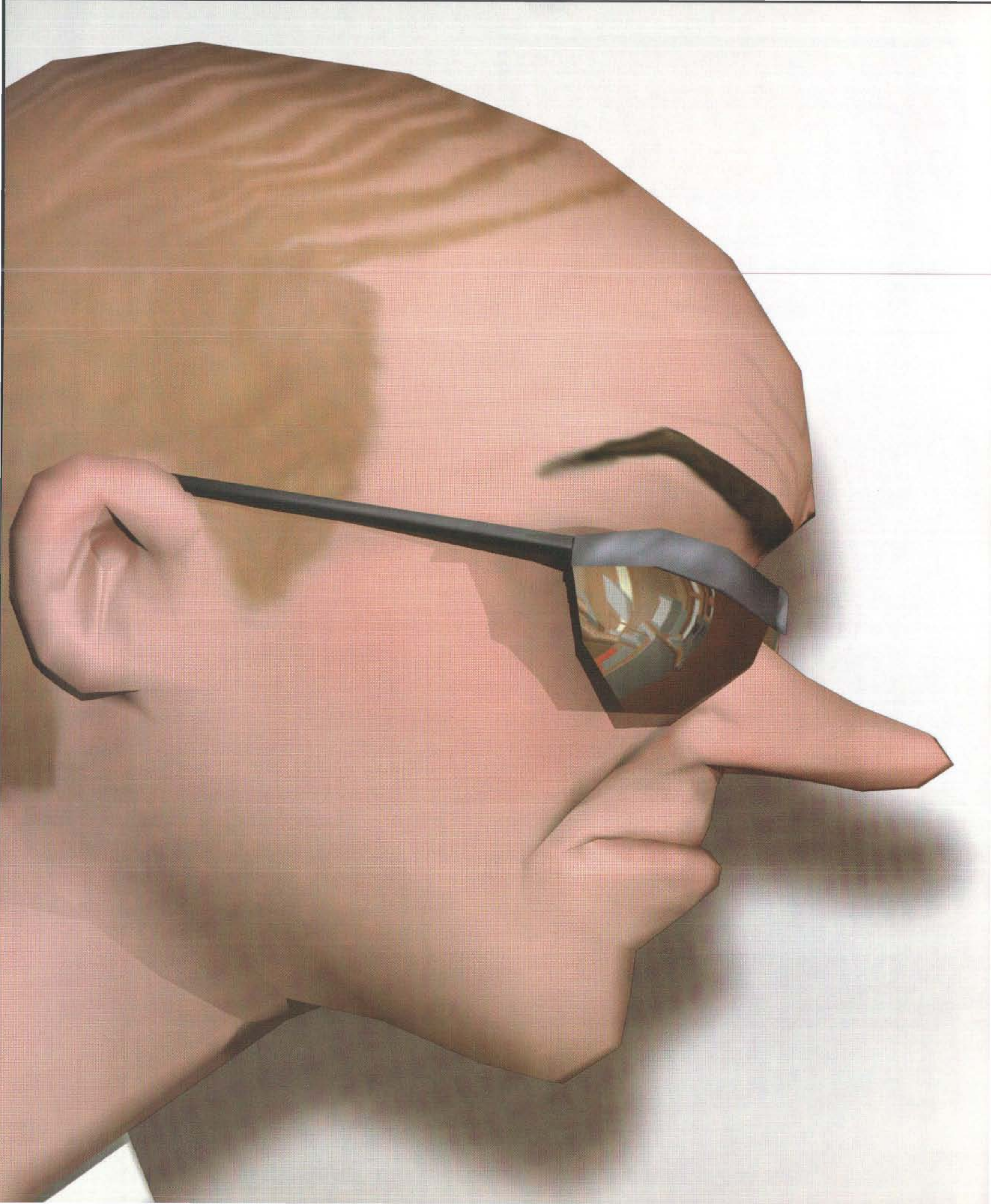
The lessons this place holds have a global scope: They speak to the developed world about the real cost of profligate production and premature obsolescence. A thread runs from our shiny new products to the hulks, spills, and calamities of Alang, where men risk their lives to turn one society's waste into something useful for those who otherwise might have nothing. ■ ■ ■

Laborers cut down struts alongside the hull of a heavily corroded container ship. Plot owners prefer tankers: Oil coats the ship's walls, protecting them from saltwater. This translates into a larger yield of recyclable steel – and greater profits when the scrap is sold.

Garry Trudeau, in his Upper West Side studio, with presidential candidate Duke, who will fight Pat Buchanan for the Reform Party nomination at the national convention August 10.


BUILDING A BRIDGE BACK TO THE 20TH CENTUR
Duke's to-do list
1. pick up dry cleaning
2. invade France
It's never personal. Not to sound like Tony Soprano, but it's my job
WSJ editors clinically insane
Motorcad
• VICE PRESIDENT KATHIE LEE GIFFORD
Note to self: THE STRIP IS
The
has g
hand

THE REVOLUTION WILL BE SATIRIZED



D2K "campaign headquarters" in Coon Rapids, Minnesota, a familiar sight to viewers of *www.duke2000.com*. The set is actually housed in the studios of San Francisco's dotcomix.

Garry Trudeau is on a digital roll, reveling in dotcomedy – and chasing vertical eyeballs with his 3-D, full-motion, cross-platform Duke2000 campaign.

By Edward Cone

DOWN ON ALL FOURS, *Doonesbury* creator Garry Trudeau is yapping like a dog, a small, annoying dog – the kind that might serve as a suitably cranky mascot for Duke, the long-lived, drug-ingesting Trudeau creation who's running for the Reform Party presidential nomination this year. The yipping is just one of many sound effects provided by Trudeau for actor Fred Newman, who, playing the part of Duke, is doing some barking of his own – at a Detroit DJ on the other end of the phone.

It's noon on an April day in Trudeau's Upper West Side studio, and this is the 24th radio show that the team has done since 6 am in support of Duke2000. Some have gone better than others. (A joke about Maya Angelou being responsible for the booming economy, for example, knocks 'em dead on NPR, but falls flat everywhere else.) With his shoes off and his hat on backward, wearing a V-neck sweater over a T-shirt, Trudeau, a youthful 52, looks like a grad student after an all-nighter. "I'm too old for this," he protests while relaxing at a drafting table between calls. But when the phone rings, he jumps back to work. As Duke takes the usual questions and spits back the answers (on his political record: "I've run from things, not for things"), Trudeau is slamming a door, cranking up the stereo, punching up lines for Newman on a blueberry iMac, laughing silently at his delivery, and yipping some more. The segment ends, and it's straight into Phoenix for the last show of the day.

If the image of America's preeminent political satirist imitating a lap dog isn't unusual enough, the fact that he's doing it as part of a media tour – and with me watching – is truly out of character. Trudeau hasn't done an extended interview in 10 years, but D2K has loosened him up, partly because the experimental venture needs his support, and partly because he's nervous about the future of print, where he made his reputation. Trudeau seems well aware that the digital world he's temporarily exploring with the Duke campaign is where his career is headed, and he knows it's high time he got on the fast track of 21st-century media.

Having introduced Duke as a *Doonesbury* character in 1974, Trudeau has since used him to send up everything from Sino-American rapprochement to the Iranian hostage crisis and the social policies of Newt Gingrich. Surveying the cartoonish landscape of presidential politics last fall, Trudeau decided that Duke was an ideal candidate for these times. In previous campaigns, that would have meant a recurring story line in the Pulitzer Prize-winning strip – a chuckle, in other words, for consumers of comics in any of about 1,400 daily and Sunday newspapers. This time around, it means a multichannel project playing out not just in print and on the radio, but via groundbreaking animation technology on television and the Web, at Duke2000.com. The media splash is giving Trudeau unparalleled exposure to new audiences while allowing him to test out alternative venues for his art.

"I have to keep in mind where I will be 10 or 20 years out," says Trudeau the day before the radio blitz. Speaking recently at Harvard Law School and Brown, he says, he met kids who had never seen *Doonesbury* in a newspaper but knew it well from the Web. "Part of this project is to determine whether a Web-based video strip is something worth pursuing. The jury is still out on that, but I'm compelled enough by the keys to the new economy – fear and greed – to investigate a chance to reinvent the strip in a new medium."

For nearly 30 years a clear-eyed observer of our cultural attitudes and pretensions, Trudeau embarks on decade four believing that no topic is more important than technology – not only as a medium for his ideas, but as subject matter for his work. The Internet, he says, provides "perfect conditions for social satire – the creation of astonishing, overnight fortunes, and the impact of early wealth on a subgroup not famous for emotional maturity. We're remaking ourselves online, a fumbling process that is incredibly dynamic; we're reinterpreting the way we organize ourselves ethically in situations that have never existed before, from what constitutes piracy to what we mean by privacy."

The freshest story lines in *Doonesbury* these days often concern the new economy of startups and flameouts (like the rise and fall of MiKim, the software firm cofounded by Mike Doonesbury and his wife, Kim), a milieu Trudeau captures with the same of-the-moment precision he once brought to Vietnam and Watergate. Tech culture is also at the core of Trudeau's *Killer App*, an hour-long TV drama set at a New York software company, which, having recently been killed by Fox for the second time, is being shopped to HBO, among

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Contributing editor Edward Cone (efcone @mindspring.com) *wrote about State Street Corporation in* Wired *8.06.*

PREVIOUS PAGES: PHOTOGRAPH: CHRIS BUCK; ANIMATION: DOTCOMIX. OPPOSITE PAGE: PHOTOGRAPHS: ED KASHI

others. "The multitasking has gotten a little out of hand this year," says Trudeau, who calls *Doonesbury* his "core business" and plans to continue the strip until he retires.

Clearly, though, he's having fun with the extracurricular work, flying (coach) back and forth to San Francisco with Newman to support the animation production for Duke2000, honing *Killer App* with executive producer Tom Fontana, working on charity projects with Starbucks. He's stretching his creativity at a time when a lot of successful careers would be running in place. "I was just following my curiosity," says Trudeau about his current spate of activity. "Recently, I've been thinking a little further out."

DUKE'S FIRST LIVE APPEARANCE occurred last winter at a press conference during the HBO/US Comedy Arts Festival in Aspen's St. Regis Hotel. The character looked down on the ballroom (via satellite from his "campaign headquarters" in a cheap hotel room in Coon Rapids, Minnesota) from two outsize screens at either side of the stage. Meanwhile, Trudeau and Newman huddled with the crew from dotcomix, the San Francisco animators who bring Duke to life, in a makeshift control room curtained off from the audience. Trudeau was cuing Newman with a laser pointer aimed at a wallboard full of scripted responses. Newman wore a motion-capture suit, sensors velcroed to his body, that fed data to a computer that syncs his movements to Duke – allowing the onscreen character to shrug his shoulders, point his fingers, and move about. A joystick-wielding puppeteer stationed nearby brought Duke's facial expressions to life; Duke's mouth moved in response to particular sounds, called phonemes, in a fraction of a second, syncing his lip movements with his speech.

At first, the crowd seemed a bit underwhelmed. What they really wanted was to run into Steve Martin or Robin Williams on the elevator – not to sit through political shtick at 3 in the afternoon. Slowly, they began to warm up. When actress Lauren Tom appeared onstage as Duke's faithful right-hand woman, Honey Huan, they chuckled. And Duke got some laughs on a couple of cheap gags, including a politically incorrect crack about Honduran gardeners. But not until Duke answered a couple of questions did the audience realize this wasn't just some nicely timed video; it was real time. Duke heckled an unsuspecting cougher in the audience. The energy level in the room tripled. Someone asked about the WTO riots, and Duke fired back a snarky remark. Then the computer crashed. End of story. Tom shifted to the fallback script crafted for such occasions, which, along with some pithy ad-libs, brought her gracefully to the end. And Trudeau walked away unrecognized – happy with the premiere, if a bit disappointed at its premature ending.

A month later, Duke is on *Larry King Live*, sharing the screen with the host, gesturing with a long cigarette holder while laying out the platform he calls "compassionate fascism." The candidate glowers behind his mirrored shades during one heated moment, coughs violently, and falls down. The other guests, including political commentators Rowland Evans and Robert Novak and comedians Al Franken and Bill Maher, try not to laugh. As satire, it scores a few points for subverting the self-seriousness of talking-head TV.

Live television is hard enough on the usual talking head (take Maher, for example – his material fell flat on *Larry King*). It's unprecedented for an animated character. (Protozoa, an earlier incarnation of dotcomix, produced a lo-res, prerecorded forerunner named Dev Null for MSNBC's *The Site* in 1996.) But, prone to debilitating acid flashbacks and arguments for mandatory gun ownership, Duke was made for live TV. As he banters with King, the 40-person team that gives him the ability to keep up in a real-time conversation is gathered at dotcomix's San Francisco studio, crowded into a conference room to watch the broadcast.

It's a nervous hour, a high-visibility demo for the company's most sophisticated product. "This is live theater – as live as it gets," says Buzz Hays, the project's executive producer and a graduate of the USC film school. Hays has run Lucasfilm's THX research unit, coproduced the Kevin Spacey film *Swimming With Sharks*, and overseen the much-hyped *9* for Robert De Niro's Tribeca Interactive. "It helps that we didn't have to do eyes. The sunglasses are really a godsend in terms of processing power," he says.

"A decade ago, my work seemed outrageous. These days, Leno clicks off a half-dozen Clinton fellatio jokes in a single show," Trudeau says. "I have no desire to follow comedy down that particular road."

Outside the dotcomix studio, a CNN truck with a satellite link is tethered to the building by cables. Inside, it's Aspen all over again – but on steroids. Trudeau has his pointer, and Newman's in his special getup. But tonight the computer is a souped-up SGI Onyx2 supercomputer on loan from its maker. The Onyx2 and its premium graphics engine, commonly used for tasks like modeling combat weaponry and medical diagnostics, creates a world not just of shape but of texture as well. Plus, with four 64-bit MIPS R10000 processors, it will not go down.

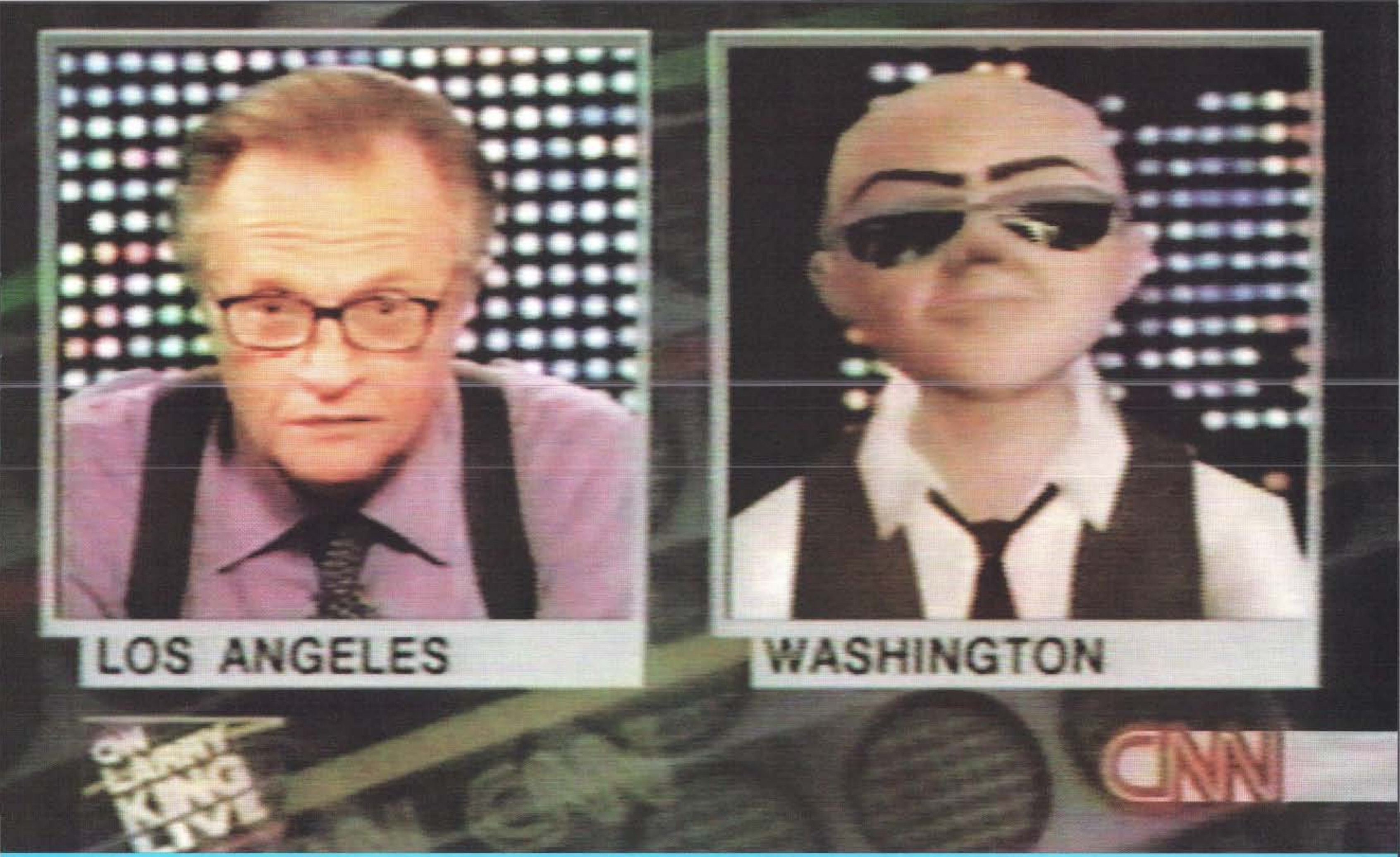
To Hays, the technology is merely a way of creating a better ride for the audience. "One thing about dotcomix that's also true of the Lucas culture is that we're focused on the experience – not just the nuts and bolts," he says. "My goal is to bring a sense of theatricality to it."

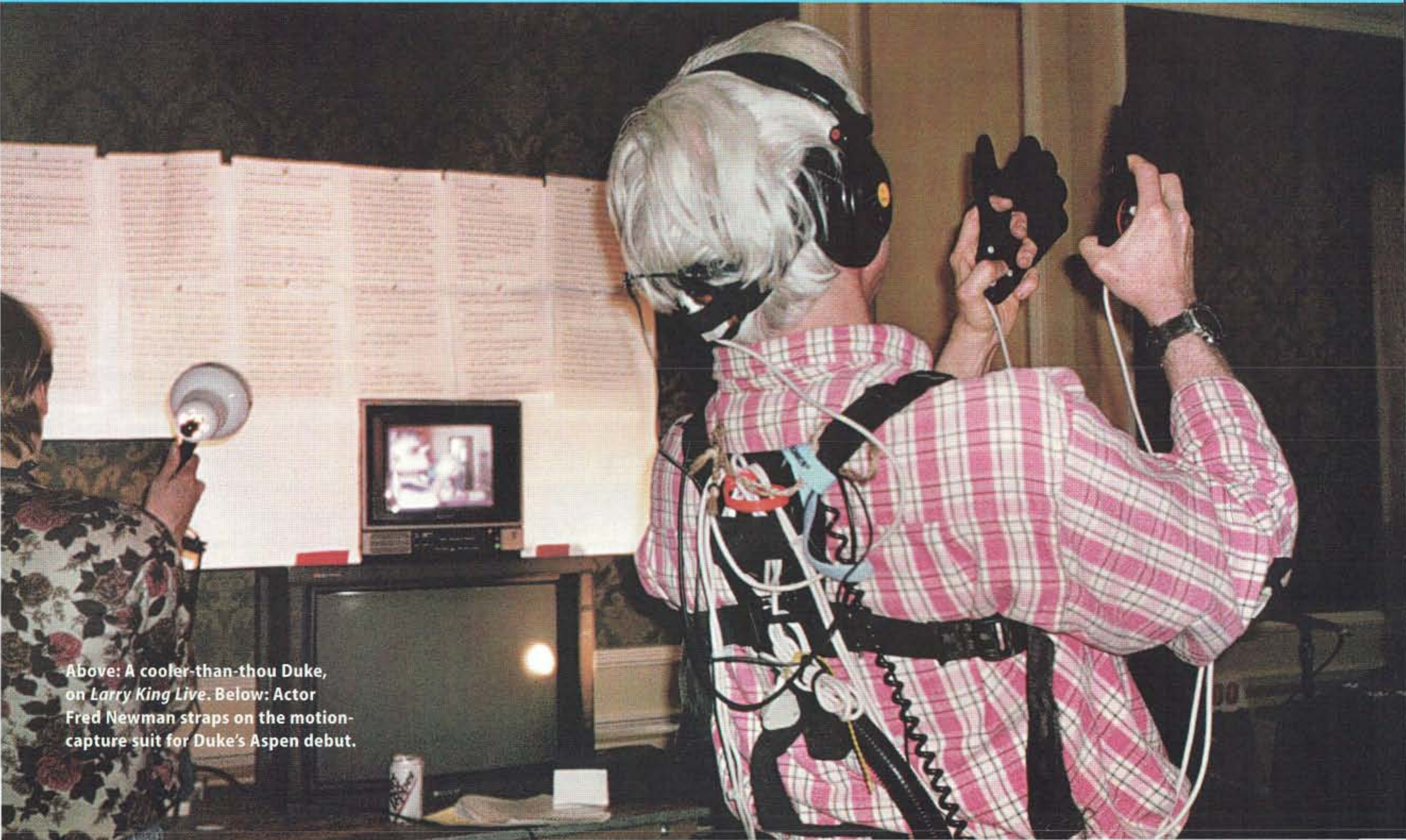
Of course dotcomix is as concerned with commerce as theater. Damon Danielson, the CEO brought in to raise capital and run the business end, had hoped the project would be paying some of its own freight by now, but a $2.1 million sponsorship and distribution deal with Excite fell apart, and endorsement contracts have not materialized either. Newman and Trudeau both draw regular paychecks, character rights have to be paid for, and the cost of video production and maintaining the impressive Web site add to the expense. Duke2000.com, which is drawing about 3 million hits a month, includes a weekly address from the candidate – produced using Alive, a proprietary technology that lets Duke move his eyebrows and appear to breathe – done in full video resolution.

"We would like to monetize the project," says Danielson. "We've accomplished our goals. We're raising our profile and proving the model. Now we're focusing on bringing those dollars back in."

Investors, including the Canadian cable company Rogers Communications, put $8.5 million into dotcomix in April, filling the company's coffers while also raising expectations. The business plan is to create "channels" of content for specific audiences ("vertical eyeballs," Danielson calls

TV STILLS: CNN *LARRY KING LIVE*; PHOTOGRAPH: DAVID STANFORD





Above: A cooler-than-thou Duke, on *Larry King Live*. Below: Actor Fred Newman straps on the motion-capture suit for Duke's Aspen debut.

them) on the Web, then sell sponsorships on the channels and, if possible, repackage the programming for TV. For now, TV animation brings in some revenue, but losses are expected for the next couple of years, and working up to the planned late-summer launch of a broadband animation channel hasn't been cheap. "We're committed to staying with Duke2000 through the conventions, and we'll keep going if we can to the election," says Danielson.

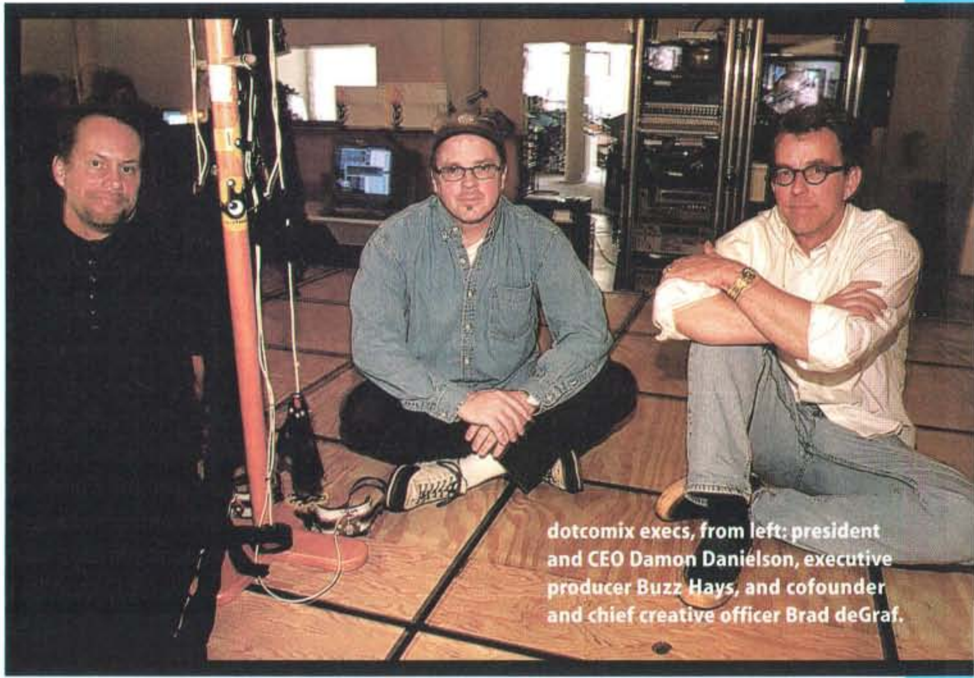
Brad deGraf, dotcomix cofounder and an icon in the world of 3-D animation who helped develop the company's authoring technology, is more philosophical. "I'm behind doing it all the way to the end. It's really starting to jell," he says, adding that the value of Duke2000 goes beyond branding the company to demonstrating a new way of defining and marketing content. "This project is naturally transmedia. It can't live in any one medium; it's not limited to TV, or the Web, or print, or the radio. And for the first time, you can give a character a brain."

Trudeau and deGraf met when dotcomix animated Jimmy Thudpucker, *Doonesbury's* over-the-hill folk rocker, for Netaid.org's 1999 concert. After seeing the October 1999 *Doonesbury* strips in which Duke considers running for the White House, deGraf reached out with an idea. Says Buzz Hays, "We decided early on that Duke would be integrated into the real world. I asked Garry if he had considered the *Roger Rabbit* approach, and he said, 'You can do that?'"

DeGraf thinks that major sponsors may still come on board, especially those aimed at the broadband-rich college audience that will return to school just as the presidential race hits high gear. A live campus tour and regular spots on *Conan O'Brien* and MTV are also possible, he says, as is an eventual mockumentary about the campaign. In the meantime, he enjoys the drama of having the candidate mention products in hopes of gaining an endorsement. "We haven't gotten any money, but we did get a box of Lipton tea," he says, as a result of Duke declaring Lipton the official stimulant of his campaign.

Trudeau and Newman would like to keep D2K going through the summer, then really crank up the campaign after the conventions. To Newman, the possibilities offered by the technology are immense. "Puppetry is no longer required to create an imaginary character that can move and talk in real time," he points out. "You can put Ben Kingsley in the motion suit and let him do anything. He could transform into anybody."

Trudeau, who says Duke will run as an independent or as the head of his own party if he loses the Reform nomination to Pat Buchanan at the national convention August 10, can't imagine what Duke2000 will look like by November. "Everything we're doing seems to be a dress rehearsal for what follows," he says. "We have nothing to compare it to. Who knows where this is supposed to lead?"



dotcomix execs, from left: president and CEO Damon Danielson, executive producer Buzz Hays, and cofounder and chief creative officer Brad deGraf.

FIVE PRESIDENTS SHARE THE wall-sized canvas that dominates the sitting room of Trudeau's studio, a sunny fourth-floor walk-up near the American Museum of Natural History and not far from his home. The painting, which Trudeau commissioned, is by Philip Burke, best known for his contorted, violently colored illustrations on the contents page of *Rolling Stone*. Like stuffed heads on a game hunter's wall, the caricatures (shifty Nixon, doofy Ford, bemused Carter, vacant Reagan, prissy Bush) are a reminder of how Trudeau made his reputation. "Taste is important to me, the feel of a place," he says of his carefully appointed workspace.

There's a Chuck Close silk screen on one wall, across from a pair of small Warhols depicting a young Trudeau, plus several toy-cowboy tableaux by the photographer David Levinthal, with whom Trudeau collaborated just after graduating from Yale. But politics dominates the subject matter of the art and mementos in the apartment. There's another Burke (Nancy Reagan rampant beside a pinheaded Ronnie) in the back room where Trudeau draws *Doonesbury*. Also in the back room are framed drawings by editorial cartoonists, including Mike Peters and the late Jeff MacNelly, many signed and many making reference to Trudeau and his strip as players in national affairs. And a framed drawing by Ralph Steadman presents Nixon adrift in a rowboat. A photograph of a bearded Trudeau and then-President Jimmy Carter is inscribed "with admiration to Garry Trudeau, a valued analyst of the American Scene." His Pulitzer for editorial cartooning, the only one ever awarded for a daily strip, hangs discreetly in the small kitchen.

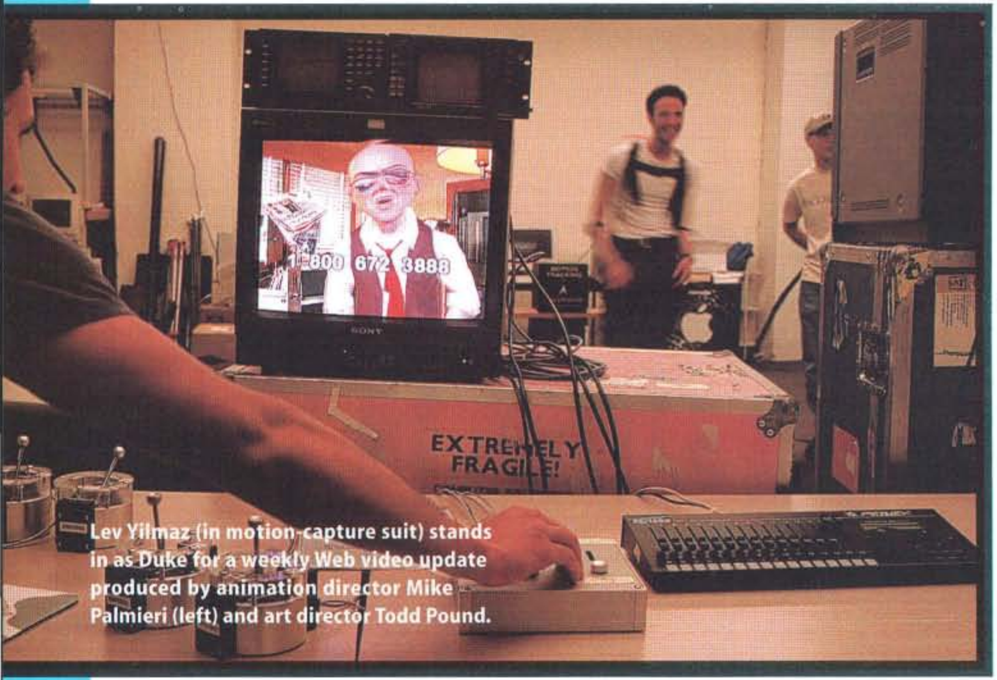
Raised by Eisenhower Republicans and politicized by the war in Vietnam, Trudeau has never been a lockstep Democrat – a charge he's heard frequently since he began drawing *Doonesbury*. He grew up in the small Adirondacks town of Saranac Lake, where his father was the fourth generation of the family to practice medicine and a respectable member of the provincial gentry. "His good reputation meant everything to him," says Trudeau.

His parents divorced when he was 12 and his mother, having inherited money from her father, an early IBM employee, moved to Manhattan and introduced him to a more privileged lifestyle.

PHOTOGRAPHS: ED KASHI

Young Garretson Beekman Trudeau became a painter, copying the style of everyone who impressed him, from Goya to Oldenburg. "I was an academy kind of guy, doomed to fail," he says. "I inadvertently acquired too much respect for my betters to imagine myself in their number."

By his sophomore year at Yale, Trudeau had given up painting and moved on to graphic arts, a better field for what he calls "a more modest talent." After feeling out of place in boarding school – "maybe that would have been true anywhere," he says – Trudeau flourished in college, finding friends who shared his interests in art, journalism, and theater. His creativity soared. As a junior, he developed *Bull Tales,* a talky, four-panel strip focusing on hero quarterback B. D. and his amorously challenged roommate, Michael Doonesbury. It debuted in the *Yale Daily News*.


Lev Yilmaz (in motion-capture suit) stands in as Duke for a weekly Web video update produced by animation director Mike Palmieri (left) and art director Todd Pound.

Shaggily drawn but sharply written, *Bull Tales* was picked up in 1970 by the fledgling Universal Press Syndicate, which was looking for a youth-oriented strip. It launched in a slightly cleaned-up form as *Doonesbury*. (The name came from combining the prep school slang "Doone" – "a good-natured fool," says Trudeau – with the name of his own roommate, Charlie Pillsbury.) Within a month, Trudeau was making fun of white liberal guilt on the funny pages, and soon his characters were commenting on Vietnam and other subjects that never came up in *Blondie*. By the time he got his master's degree in graphic design from Yale in 1973, he was firing at will in a target-rich environment. His takes on Watergate (the gradual building of a wall around the White House, the chant of "Guilty, Guilty, Guilty," from former campus radical Mark Slackmeyer, the sunny day when the wall came down) were devastating; his humanizing view of B. D. the GI and Phred the Viet Cong, a relief.

His earliest strips display the political ecumenicism he claims, mocking the extremes of the SDS, albeit with a wink. The opinion page of *The Wall Street Journal* even once reprinted two weeks' worth of *Doonesbury*. "Close readers of the strip know that, on many issues, I'm a social conservative, something that's been obscured by the static created by my various progressive stances," he emails me. He and TV celebrity Jane Pauley, married since 1980 and highly involved with their three teenagers, share what some of his satirical targets would call Family Values.

His sharp-edged style has made him some enemies, including the Bush family, which never got over Trudeau's depictions of then-vice president George Bush. In 1984, the cartoonist placed Bush's manhood in a blind trust so that the veep could become a Reaganite. Jeb Bush, now the governor of Florida and a brother of the presumptive Republican nominee, George W., confronted Trudeau at the 1988 Republican convention, demanding that he ease up on his father. "He said, 'I have two words for you: walk softly,'" Trudeau remembers. "It was a real productive conversation."

Jeff Greenfield, the veteran political commentator, first covered Trudeau when he was still studying at Yale. "Decade after decade, he's been able to pick out the soft underbelly of a political guy," says Greenfield. "He has perfect pitch."

Doonesbury made Trudeau a star, but he didn't appreciate all the attention. He enjoyed high-profile gigs like drawing magazine covers for *Rolling Stone*, but the prospect of sitting for a cover-story interview with *Time* was so upsetting that he threw up on the way to New York and had to bail. "I didn't miss the meeting," he says. "I just decided on the spot not to do the interview." He spoke to the press a lot in the early years, but eventually stopped because he saw no discernible benefit to hawking the strip.

In 1983, Trudeau did something unheard of for a cartoonist. He took a 21-month sabbatical that freed him up to work on a *Doonesbury* musical and allowed him to figure out what would come next for his cast of characters, who hadn't developed much since their college years. When he came back to the strip, the drawing had gone up a notch, too, but *Doonesbury* had always been above all a written work. "He's an amazing writer; that's what his strip is about," says political cartoonist Ted Rall. "It's a cool mix of the way people speak and the way they ought to speak. Cartoonists hate it when other cartoonists boldface the wrong word or put the exclamation point in the wrong place. He doesn't do that."

Working with a 10-day lead time for the daily strips and five weeks for the Sunday edition, Trudeau has managed to keep his material current with remarkable consistency. Recently he has been fascinated by the antiglobalism protests in Seattle and Washington, especially the affinity-group tactics used by the protesters, which he notes "could be a new way for individuals to confront and deal with organizations."

Being a parent, he's able to make his younger characters sound young, although as a group, they will never have the freshness of their forebears, or the emotional resonance for their creator. "Mike is obviously a generational touchstone for me, but Zonker is unique and first among equals, my Snoopy," he says.

AS IMPORTANT AS POLITICS HAS been to Trudeau, much of his recent political material seems less inspired. This is due in part to his own ideology, but also because politics in general doesn't dominate the culture as it did for much of the '70s and '80s. "It's not as biting now," says Greenfield of the Clinton-era *Doonesbury*. "He's more hostile to the Republican Congress than he is to the vaguely liberal president. A Newt Gingrich or a Reagan gets him going more than the corruption of language of a Clinton."

Says Rall, whose hard-edged liberalism gets frequent play in the *New York Times* opinion pages, "He can be a devastating commentator when he wants to be – but, like the other Democratic cartoonists, he ran like a pussy during the impeachment." Consider Trudeau's symbolic representation of Clinton as a waffle, an image that not only lacks the satiric wallop of the bomb used for Gingrich or the feather for Dan Quayle, but also fails to address this president's deepest and most widely understood flaws.

What's certain is that the strip many newspapers carry on their op-ed pages is less controversial than it once was. Satire, which depends on exaggeration to score its points, is reduced to mere parody in the face of Swiftian elements like the semen-stained dress and Jesse Ventura. "Politics matters when there is an urgent need for change, when there's an air of crisis," says Trudeau. "The rest of the time, politics is government – my world in the '50s. Right now, most people are pretty content, which is why it makes perfect sense that the two major candidates are centrists, and Buchanan barely registers."

"I'm guessing that a) people are simply used to the strip or that b) the growing coarseness of political satire and commentary has rendered my work less inflammatory in comparison," he emails. "A decade ago, my work seemed outrageous compared to *Tonight Show* jokes; these days, Leno clicks off a half-dozen Clinton fellatio jokes in a single show. I have no desire to follow comedy down that particular road. Of course, one could argue that my early edge was part of the cultural shift that eventually begat (or be-shat) *South Park* and its numerous kin, so my position doesn't exactly lend itself to smugness."

Duke2000 is one way of kick-starting political satire in a less-than-thrilling election year. At the same time, the other *Doonesbury* characters – who have always thoroughly inhabited popular culture, giving the strip its soap opera addictiveness – have become fixated on business and technology to the same degree as their readers. There was a computer joke (about poorly matched roommates) in the first *Doonesbury* ever drawn, and early on, there was a story line about geek culture at a computer center during the mainframe era. But technology emerged as a frequent theme only with the advent of the PC in the '80s and grew with the Web in the '90s.

There was lonely Mike, chatting online as his marriage fell apart. More recently, Microsoft crushed his software company, a failure that has led to Internet companies courting Mike as CEO. "I learn a lot about tech culture just by reading and paying attention," says Trudeau, who has used a Mac since 1984 and came online during the brief heyday of CompuServe.

That knowledge, and the ability to explore it through his characters, has given Trudeau a healthy new store of satirical targets and a suitably far-reaching social phenomenon to chronicle. Mike and Kim's adventures in software and Alex's precocious Web savvy are as timely in the national discourse as were Joanie's divorce and Mark's gay marriage, but they are woven together as part of a larger theme, a new economy that is broad enough to sustain several story lines at once. It's a movement big enough to frame his work and occupy his characters in postpolitical times – and a natural target for a writer who first made his reputation as a voice of the '60s youth culture. He hasn't yet drawn a real-world tech figure like Bill Gates into the strip in the way he's done with Donald Trump, but he's definitely interested in the players on the business page. "I find all the personal stories – Gates, Myhrvold, Clark, Jobs, Andreessen, Yang – compelling, probably because I'm old enough to think it's cool that geeks, the lowest caste in my high school, currently rule."

The flip side of that, he says – the part that demands comment – is the "odious" greed and "the sense of entitlement in the ranks of the cognitive elite."

PART OF HIS COMMENTARY on technology, Trudeau hopes, will come across in *Killer App* – a story about a company that develops a revolutionary method of sending full-motion video over the Web – which was up for a possible midseason replacement slot on next season's schedule until Fox killed it in May. The network had already passed on one pilot for the show, developed by Trudeau with his friend Robert Altman, but seemed ready to bite on a recast and retooled version, this one helmed by Tom Fontana, best known for NBC's *Homicide: Life on the Street* and HBO's grisly prison drama *Oz*.

For Trudeau, the canceled reshoot is just the latest delay in a three-year effort to get *Killer App* into production. Even before the latest news from Fox, Trudeau was wondering aloud if the show didn't belong on HBO, where his Emmy-winning *Tanner '88* series (also directed by Altman) ran and a smartly written show like *The Sopranos* can become a breakout hit. "We were disappointed for about 5 minutes," says Trudeau of Fox's decision. "We saw all winter how hard they pushed to make it more of a Fox show, with pretty kids jumping into bed with each other. We now feel less pressure to do the kind of show that Fox feels comfortable with."

In the latest iteration, *Killer App*'s setting has moved from Seattle to Manhattan's Silicon Alley, making production more convenient for Trudeau and Fontana, who is also based in New York and who, along with partner Barry Levinson, gives the project some helpful showbiz heft. Trudeau consulted with an engineer he met while making *Doonesbury* CD-ROMs in order to salt the dialog with plausible (if dumbed down) technospeak. "He worked up these incredibly dense problems, and I stripped them down and vernacularized them," Trudeau says by email. "The trick, of course, is to convey verisimilitude but keep the focus on the characters."

Creating drama out of the technology business is easy enough even in real life, and Trudeau has sketched a swift story that involves hot technology, perfidious financiers, and a villainous software magnate who, as the world's richest man, is obviously inspired by Bill Gates – yet with a personality drawn from, say, Larry Ellison. The show is stocked with predictable types – the neohippie visionary, the opportunistic VC, the scruffy coding genius – all of whom could quickly degenerate into clichés if not handled carefully. But *Killer App* already has some characters with potential, including Pam Thieu, a young

Hunter S. Thompson holds no special place for the character he inspired – or for Duke's creator. "Trudo [*sic*] is dumb like Gore and greedy like Bush," he scrawls in a note. "I might shit on Trudo's chest – is that a crime?"

software engineer probably inspired by *Doonesbury*'s Kim, also a software guru. With five finished scripts and a sixth in outline form, Trudeau is confident that the characters will be well-defined. "Character development is extremely important, and probably plays to my strengths – not to mention Barry and Tom's," he says.

It's true that *Doonesbury* is populated with some highly evolved and complex personae; this complexity is the key to the strip's enduring popularity. But creating similar depth in a weekly TV series is a different challenge.

Trudeau has ventured into other media several times in the past, with mixed results. The 1983 musical version of *Doonesbury,* written for the stage with composer Elizabeth Swados, was a modest success. His Reagan-era touring revue, *Rap Master Ronnie*, another collaboration with Swados, proved to be a cult favorite at best. And the political satire *Tanner '88* was the critics' darling. He has turned out a handful of well-regarded but unmade movie scripts, including one about a New Right operative called *Special Interest* for Robert Redford, and is now working with Fox Searchlight to develop a film about biomedical research.

The latest ordeal with Fox has done little to assuage Trudeau's well-earned wariness of the entertainment industry. He's not banking on the show being a success. "I'll believe it when I see it," he says. "It's a good thing I have a day job."

ALTHOUGH TRUDEAU MAY BE bowing to the power of television with *Killer App*, Duke2000 is a lot closer to what has made Trudeau the man he is – it's smart, funny, and not subject to the whims of content boards or focus groups. Both Trudeau and his friend Fred Newman, who played Jimmy Thudpucker for the Netaid project, are jazzed at the chance to work together again. "We laughed so hard we were crying while we wrote yesterday," says Newman, a former host of the Britney Spears-era *Mickey Mouse Club*, author of a popular book about creating odd noises with one's mouth, and a working actor with a Harvard MBA. "We're comedically in sync. We're able to improvise."

In truth, the improv can be a stretch for Trudeau. "My natural inclination would be to have every word scripted, but Fred brings this observational touch to it," he says. "We introduce new words because his ear is so good, and it's worth the trade-off."

Trudeau sees Duke2000 as important to his own socialization process. *Doonesbury* has always been a solitary pursuit. He compares it to a writer's relationship with his journal, saying, "It may contain his deepest feelings, but when he's not actually writing in it, it's just a book sitting on his desk." Collaborating on Duke2000 brings out the best in him. "Working with actual people is a good way to air your brain out," he says. "The older I get, the more I seem to need it."

Brad deGraf calls him a perfectionist. "He has characters that he's nurtured over the years, so it can be hard to write for him, but the collaborative effort is great. We're very simpatico conceptually," he says.

When the idea of a character running for president came up, Duke was the obvious choice. "Zonker would have been too limited as a candidate by his nature, which is sweet," Trudeau says. He was looking for something a little rawer than Walt Kelly's seminal Pogo-for-President campaign from the '50s, and harder to ignore than Pat Paulsen. Duke, first seen in 1974 in his office at *Rolling Stone* after a bout with too much tequila and Coke, using a ruler to kill bats that only he could see, and subsequently becoming governor of American Samoa, ambassador to China, and a zombie, among other things, had the qualifications Trudeau was seeking.

His colorful past also distinguishes Duke from the character's original inspiration – Hunter S. Thompson, says Trudeau. Both Duke and Thompson (who used the name Raoul Duke as an alter ego in his work) were writers at *Rolling Stone.* They both believed in better living through chemistry, but Trudeau argues that his character has long outgrown easy identification with Thompson. "Hunter Thompson would have proved limiting to the character if Duke had stopped there," he says. "His lawyers call from time to time, but he doesn't have a case."

Thompson, often quoted as saying he'd like to cause Trudeau bodily harm, now denies making the threats. "No, that would be Felony Menacing, and I am *never* guilty of that," he scrawls in a handwritten note. "Trudo [*sic*] is dumb like Gore and greedy like Bush. My vote is Nader. I might shit on Trudo's chest – is that a crime?"

Duke, the candidate, is entertaining, if somewhat diminished in impact by the stranger-than-fiction nature of the Buchanans, Venturas, and Trumps of the world, and Trudeau says entertainment is the first goal of D2K. What people take away is an open question. "We want him to be John Rocker pretherapy, somebody nobody can get behind," says Trudeau. "If we created what Warren Beatty did with Bulworth – and to some extent this applies to Tanner – a candidate that people would say, 'Yeah, I agree with that,' then we failed. That was a conscious decision."

"A lot of people aren't going to understand the irony at all," counters Rall. "It's like the nimrods who wore ARCHIE BUNKER FOR PRESIDENT buttons because they liked what he was saying."

Newman, who grew up knowing a lot of Dukes in La Grange, Georgia, says his role lets him understand the pleasure of playing a villain: "You let out your hidden desires." Trudeau says he's not venting any steam with Duke's politically incorrect dialog and relentlessly obnoxious behavior. "I have no inner Duke," he says.

Wherever Duke comes from, he's endowed with a fresh existence unlike that of any other fictional character before him. The White House may be out of his reach – "He's done a good job of not peaking too soon," muses Greenfield – but for Trudeau, given the tools to extend his own work into the newest of new media, the campaign is already a winner. ■ ■ ■

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STREETCRED

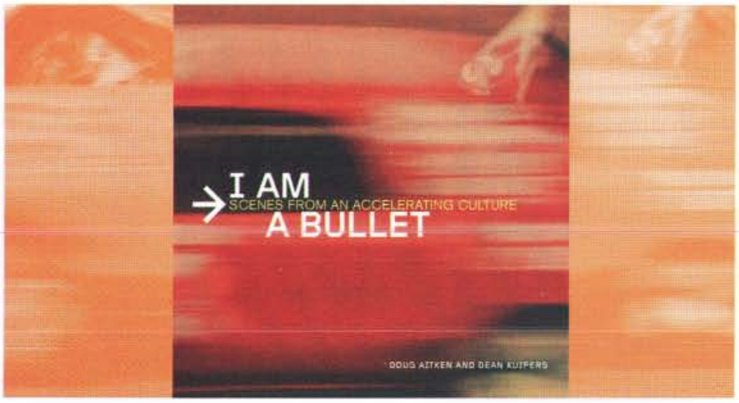
HARDWARE

Prêt-à-Portégé

As a Mac devotee, it was with great reluctance that I fell for Toshiba's skinny 4.4-pound Portégé notebook. But at 8 pounds, my trusty PowerBook G3 feels like an encyclopedia – the last thing I need when I'm running to catch a plane. It's as if I've discovered After Eight thin mints after years of eating Peppermint Patties.

The Portégé's charcoal-and-silver magnesium-alloy case is stylish, if predictable, but there's nothing prosaic about its Pentium 600-MHz SpeedStep processor, 6-Gbyte hard drive, and 64 Mbytes of SDRAM. The 13.3-inch TFT active-matrix display rocks, especially for viewing movies with the DVD Network Dock II. The 2.6-pound portable dock snaps easily onto the notebook and elevates it from mere word-processing accessory to true desktop replacement. I only wish the Portégé had an Ethernet port for quick hookups on the road. – *Tessa Rumsey*

Portégé 7200CT: $3,399. Toshiba: (800) 867 4422, +1 (949) 583 3000, *www.csd.toshiba.com.*


I AM
SCENES FROM AN ACCELERATING CULTURE
A BULLET
DOUG AITKEN AND DEAN KUIPERS

BOOK

Afterburn Rate

In our age of runaway acceleration, dreams of deceleration sit side by side with counterstrategies for becoming one with the blur. For every digital refusenik like David Shenk bemoaning "life at hyper-speed," there's a speed freak like US Air Force Captain Joe Kittinger, the Icarus in a partial-pressure suit who became, in 1960, the only human to break the sound barrier with nothing but his body. He leaped from a balloon at the very edge of Earth's atmosphere and proclaimed, "I am a bullet."

Kittinger's words title a new book with text by Dean Kuipers, former managing editor of *Ray Gun* magazine, and photographs by visual artist and music-video maker Doug Aitken. Descended from *The Medium Is the Massage* – Marshall McLuhan's eye-boinging explosion of images and oracular one-liners – *I Am a Bullet* is an extended essay on acceleration: "the prime physical, technological, and even spiritual engine of this moment." Its montaged photos and crammed copy evoke what McLuhan called the "allatonceness" of our times. Good-bye, Gutenberg: This is the print medium with afterburners.

Kuipers and Aitken seek people who are pushing the envelope of technological or social speedup, like Kittinger or test driver Andy Green, who shattered the sound barrier on land in a big black wasp of a car fitted with jet engines. When Kuipers forgets to be deep, in his bumper-sticker Baudrillard way – what exactly does "money is speed" mean, anyway? – his New New Journalism is blow-your-doors-off good fun. The sections on the demo-derby kings of Carpinteria, California, and the test drivers who dream of setting the supersonic land-speed record, are pure adrenaline, as are the photos of head-butting demo-derby deathmobiles.

But apparently it's hard to think straight in a wind tunnel. The section about truckers, "Speed as Identity," confuses a nomad's obsession with *movement* – the freedom promised by the open road – with a fetish for speed. And "Speed as Economics" focuses on auctioneers who can talk a blue streak – but haven't auctioneers been outracing the human ear for generations? What analysis the book offers on the technological and economic forces that have jammed postindustrial societies on fast-forward howls by in a kind of philosophical Doppler effect.

I Am a Bullet is a victim of its times. Even including shout-outs to Bowie and Iman in your acknowledgments and recruiting what the publisher's hype calls "one of the hottest design outfits in the country" can't save your postcards from the future from being obsolete by the time they arrive. Speed kills.
– *Mark Dery*

I Am a Bullet: Scenes From an Accelerating Culture, by Doug Aitken and Dean Kuipers: $35. Crown: (800) 726 0600, *www.randomhouse.com.*

SOFTWARE

Clean Sweep

Everybody knows that dragging a file to the recycle bin and clicking Empty doesn't really erase it from your computer's hard drive. Years later, traces of trashed files still lurk there. That goes double for floppy disks, which frequently float from business to business.

SecureClean from AccessData makes sure the deleted data on your PC stays deleted. The program scours your hard drive and floppies, erasing blocks that no longer belong to files, sweeping away space beyond the end of disk files, and cleansing deleted filenames from directories.

SecureClean took 40 minutes to clean a hard drive that held 4 Gbytes – reasonably fast for this kind of work. (The demo will perform five cleanings free of charge.) And if you're into military-grade security, you can specify multiple data overwrites, so that not even the National Security Agency can Retrieve your data. – *Simson Garfinkel*

SecureClean for Windows: free download; $49.95 for full version. AccessData: *www.accessdata.com.*

HARD DRIVE

The Institute of Higher G-Forces

If you covet the heart-pumping high of race-car driving in a lower-risk environment, fulfill your fantasies at the Bondurant School of High-Performance Driving, situated on 60 acres of sun-baked desert just south of Phoenix. Founder Bob Bondurant, who still races occasionally at age 68, has coached Nascar heroes such as Jeff Gordon, as well as Hollywood alpha males like Paul Newman and Clint Eastwood. Bondurant's 20 full-time instructors offer similar star treatment with a fleet of 120 Mustang GTs and 30 Formula 1-style Fords.

I took the three-day Mustang class. With four instructors on hand, the 11 students got plenty of personal attention. After a heavy dose of classroom theory, each of us was assigned to a bright-orange 1999 model, extensively modified with a tuned suspension, roll-bar cage, and gas-tank protection. We pushed our vehicles to the max on the slalom course, the miniature circuit, and the 1.6-mile racetrack to get a feel for the squealing limits of tire adhesion.

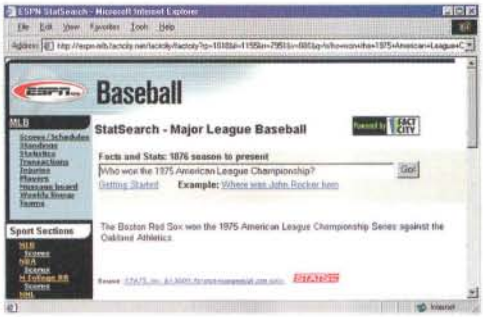
The hardest maneuver was simply going around corners. Forget everything you ever learned about braking in advance and leaving a margin of error. On a racetrack, you accelerate straight toward the corner, as if it doesn't exist. At the last possible moment, as panic rises and disaster seems certain, you brake with maximum force, then ease off as soon as you slow down enough for the front wheels to grip. (A proper turn would throw you out of your seat if you weren't wearing a full safety harness.) Then you immediately resume accelerating while you unwind the steering column – this widens your arc just enough for the inside wheels to brush the inside of the track at the turn's late apex.

By the third day, this manic-obsessive driving style seemed almost normal as I careened around the track in pursuit of my fellow students. Imagine riding a roller coaster for 90 minutes without a break, and you get some idea of the g-forces, speed, adrenal rush – and subsequent exhaustion.

Other activities at Bondurant were less intense and more applicable to responsible highway driving. For instance, we drove Mustangs fitted with a Swedish system of outrigger wheels that lighten the load on the car's own wheels, simulating the experience of driving on snow. It's a great way to learn how to handle wintertime skids and spinouts.

Bondurant also offers a "teenage defensive-driving" course, two-hour go-cart classes, and even an antikidnapping course – all with group rates for parties. And the only prerequisites for most courses are a valid driver's license and experience driving a stick. – *Charles Platt*

Three-day Mustang class: $2,400; four-day Grand Prix class (Formula 1-style Fords): $3,275. Bondurant School of High-Performance Driving: (800) 842 7223, *www.bondurant.com.*



Baseball

StatSearch - Major League Baseball

Facts and Stats: 1876 season to present

Who won the 1975 American League Championship?

Getting Started Example: Where was John Rocker born

The Boston Red Sox won the 1975 American League Championship Series against the Oakland Athletics.

WEB

Fac-droid

Remember when you bet $1 that Rollie Fingers had more than 1,300 career strikeouts – a dispute you never bothered to resolve? It's time to settle up. According to behind-the-scenes trivia engine Fact City, he had 1,299.

Fact City licenses databases of factoids to sites like ESPN.com and FoxSports.com, and has set up a decent plain-English search interface. With its precollected and structured data, Fact City instantly calls up answers, not just vaguely related Web pages. Fact City's baseball engine churns out the requisite team and player stats, as well as minutiae like throwing hand, playing surface, and – in the case of California Angels slugger Mo Vaughn – weight (a hefty 268). The answer cites the original source, so you know you're not just probing some bleacher bum's addled memory.

Besides fielding baseball queries, Fact City covers movies, music, and television on Movies.com, Wall of Sound, and Mr. Showbiz. Backed with databases from TV Guide Online, Billboard Online, and the Internet Movie Database, Fact City answers niggling questions like "Who shot J.R.?" and "What's the name of Glenn Frey's first solo album?" Unlike IMDb, where cinephile stats like the year *Chinatown* was released are still two clicks away, with Fact City, the answer comes immediately. By the end of summer, the company aims to have its databases invisibly incorporated into portal search engines and will add demographic and geographic info to the collection. That way, you can settle sports bets with your pals *and* impress your boss when you come up with the population of Mauritius. – *Evan Ratliff*

Fact City: free. Available at *fox-mlb.factcity.net* and *espn-mlb.factcity.net*, among other locations. Fact City: *www.factcity.com.*

PHOTOGRAPH: RICK SCUTERI

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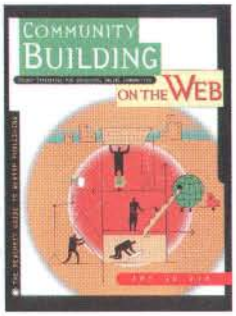


BOOK

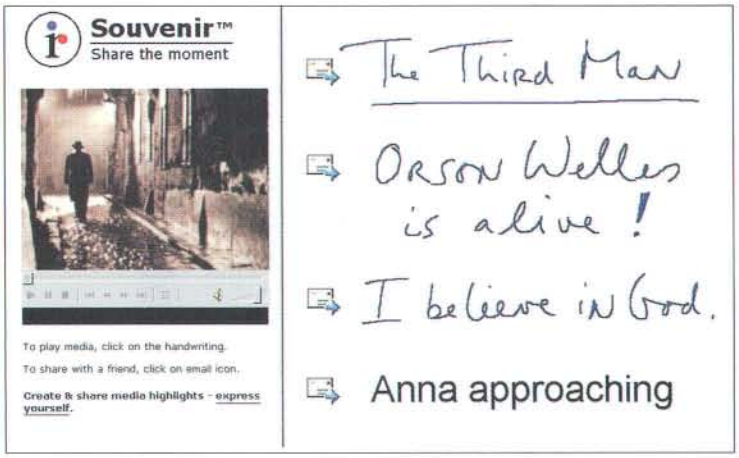
Sticky Sight

Relationships, not atoms or electrons, are the building blocks of the new economy. No village, no mall. But how does one intentionally build a community? I'm often asked that question by companies large and clueless, young and impatient, and my answer is simple: Read the book.

Amy Jo Kim, a consultant and veteran online-community builder, has distilled the essential components of this art into an understandable framework with practical nuts-and-bolts advice: how to encourage volunteers, when to nurture rituals, what to do about disruptive jerks, where to go for specialized software. It's all here. And even if you know all this, your new hires don't.

Kim also provides wonderful inspiration for noncommercial sites – say, for building dialog around a cause or a game, or bringing a flat homepage to life. This book is a short course in putting soul into the Web. – *Kevin Kelly*

Community Building on the Web: Secret Strategies for Successful Online Communities, by Amy Jo Kim: $29.99. Peachpit Press: (800) 283 9444, *www.peachpit.com*.



To play media, click on the handwriting.
To share with a friend, click on email icon.
Create & share media highlights - express yourself.

The Third Man
Orson Welles is alive!
I believe in God.
Anna approaching

SOFTWARE

Your Personal Web Scrawler

i-Recall updates humankind's age-old ability to take notes. Thanks to Souvenir, a nifty application for syncing your scrawls with video- and audiotaped conferences and presentations, you can link from your text notes to any point within a video clip, an MP3, or any other multimedia moment.

Souvenir's kernel matches a video or audio clip to real-time note-taking. The setup works because every Souvenir-compatible digital device – notebook computer, Palm, and IBM Crosspad – has an internal clock. Simply upload your scribbles, and Souvenir does the rest. The software parses notes into distinct objects and links them to event timepoints in your media presentation. If the event was streamed on the Web, you can share your annotated presentation and notes with others. To publish them online, the well-designed software interface for the PC lets users organize and combine bits and pieces of an audio or video clip quickly.

I tried Souvenir with both a Palm V and an IBM Crosspad. For the Palm, i-Recall has built a "digital ink" program that translates handwriting into text, so you don't have to be a Graffiti savant to use it. The Crosspad lets you write on a regular legal pad; your notes are picked up by the Crosspad's sensors and appear in digital format on the PC. Surprisingly, the entire process – writing, uploading, synchronizing with the media, and then publishing on the Net – was practically seamless. The only difficulty I encountered had to do with the way media content is managed on the Web. Sites often publish video clips through a convoluted channel of CGI scripts, so it can be difficult to actually locate the clip's bare-bones URL to feed to Souvenir.

i-Recall, which attracted investment from such industry luminaries as Jay Chiat, spent much of its first year ironing out software bugs. The next hurdle is making Souvenir the standard for managing rich media on the Web. Sounds good to me. When a company executive edited *The Third Man* into sections with a few scribbles on a Palm, and then sent me the clip from about halfway through where Orson Welles makes his first appearance in the film, the postmodernist in me was gleeful.

Souvenir separated art from its context without scruple. Sample some noir, anyone? – *Paul Bennett*

Souvenir: free. i-Recall: *www.i-recall.com*.

README

ON THE BOOKSHELVES OF THE DIGERATI

Lawrence Lessig

Author, *Code and Other Laws of Cyberspace*

***Genome: The Autobiography of a Species in 23 Chapters*, by Matt Ridley**

"Despite some examples of if-you-have-this-gene-you'll-get-that-condition, most gene expression is more complex, depending on environment or even on stress. The genome is both software and hardware, foundational yet changeable, and it's amazingly platform-independent – the same basic code runs on all species, with extremely small changes making the difference between a fly and a human. It's an open source coding project that runs on handhelds as well as mainframes, and 97 percent of the programming apparently does nothing, like revisions that get superseded but never discarded."

Jackie White

Conference chair, Siggraph 2000

***Tuesdays With Morrie: An Old Man, a Young Man, and Life's Greatest Lesson*, by Mitch Albom**

"Morrie says we all need teachers in our lives, and as a teacher, this really got to me, and made me realize the impact of conference planning – playing the Pied Piper to so many students, professors, and professionals. The information I gain in one week at Siggraph is more effective than anything I learn during the rest of the year. You soak it up like a sponge. I probably shouldn't be saying this, but Siggraph is like a cult – once you start going to it, I challenge you to stop."

– *Paul Spinrad*

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*Offer expires September 30, 2000.

MUSIC

Pole

3 (MATADOR)

There's a subtle beauty to Pole soloist Stefan Betke's art, such as the heartbeat-like thump that's the focus of "Karussell." This soul-stirring electronic music is created largely using Betke's defective Waldorf-4-Pole filter, which emits the kind of hiss, crackle, and surface noise of old vinyl recordings. These synthesized accidents become anchoring elements for dub-saturated rhythms. – *Tamara Palmer*

Anastacia

Not That Kind (EPIC/DAYLIGHT)

Blond, lithe, and fresh-faced, Anastacia looks like a SoCal surfer chick. But underneath that Pepsodent image lives the heart and voice of Aretha Franklin. Her songwriting talent shines through on each original track, and after years of hiding a gigantic voice behind a tiny frame, she's ready to own it. On "I'm Outta Love," the groovin' disco beat sparkles like a mirror ball against Anastacia's throaty wail. And with "Not That Kind," she puts her individuality where her mouth is. This debut also offers up a fair share of enormous, Celine Dionesque ballads, but they're delivered with a lot more soul than sugar. – *Clare Kleinedler*

Ronnie Earl

Healing Time (TELARC BLUES)

A longtime blues guitar virtuoso with a mighty appetite for a jazz riff, Earl works both genres on *Healing Time*. The all-instrumental album opens with Jimmy McGriff sitting in on the Hammond B-3 for a jazzy "Churchin'," followed by a howling cover of Muddy Waters' "Catfish Blues." Earl's got a gift for interpreting the music of others (witness the innovative bridge section he adds to Pharoah Sanders' "Thembi"), but his original score on the jump-blues "Lunch at R&M's" swings on its own. The album's most resonant performance – "Blues on a Sunday," another Earl/McGriff collaboration – has the spiritual quality of a gospel number. – *Philip Van Vleck*

Sunny Day Real Estate

The Rising Tide (TIME BOMB)

Despite their unshakable association with the Seattle grunge explosion, Sunny Day owe more to the prog-rock styling of early Genesis (circa *Lamb Lies Down on Broadway*) than to Nirvana. These 11 lushly orchestrated tracks feature Geddy Lee-like vocals over relentless drums and charged guitar work. With layered harmonic reflections and tamed piano, *Rising Tide* is their most emotive album to date. – *Dwight Fenton*

The Infesticons

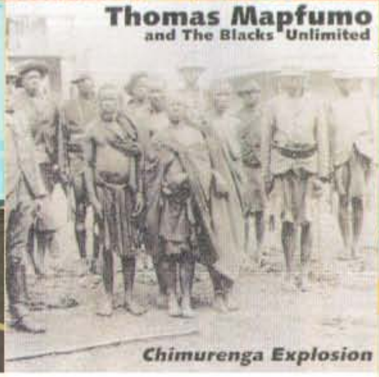
Gun Hill Road (BIG DADA)

If the seminal rapumentary *Wild Style* were ever updated for hip hop's millennial age of excess, the Infesticons would be a great choice to do the soundtrack. Here, poet-producer Mike Ladd has imagined an epic musical war in which progressive versifying crushes mainstream rap, laying the abstruse poetry of Anti-Pop Consortium, the muMs, and Saul Williams over sounds ranging from alien-invasion death rays to brooding noise-rock. – *Jon Caramanica*

Saint Etienne

Sound of Water (SUB POP)

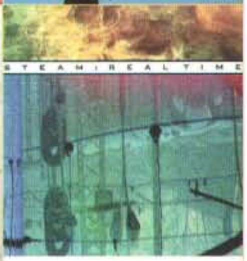
Armed with a formula for unique, kitschy dance hits, British band Saint Etienne emerged on the scene at the dawn of the '90s. The first albums were sample- and drum-machine-driven, but Saint Etienne's new release forsakes club music in favor of mature, structured compositions. Sarah Cracknell's angelic voice coats the sounds of soft tremolo guitar, gently bleeping synths, tinkling piano, and a string section produced by Sean O'Hagan of Stereolab and the High Llamas. *Sound of Water* flawlessly blends traditional instruments and modern technology to come up with symphonic electropop.
– *Paul Burkhart*



Thomas Mapfumo and the Blacks Unlimited

Chimurenga Explosion (ANONYM)

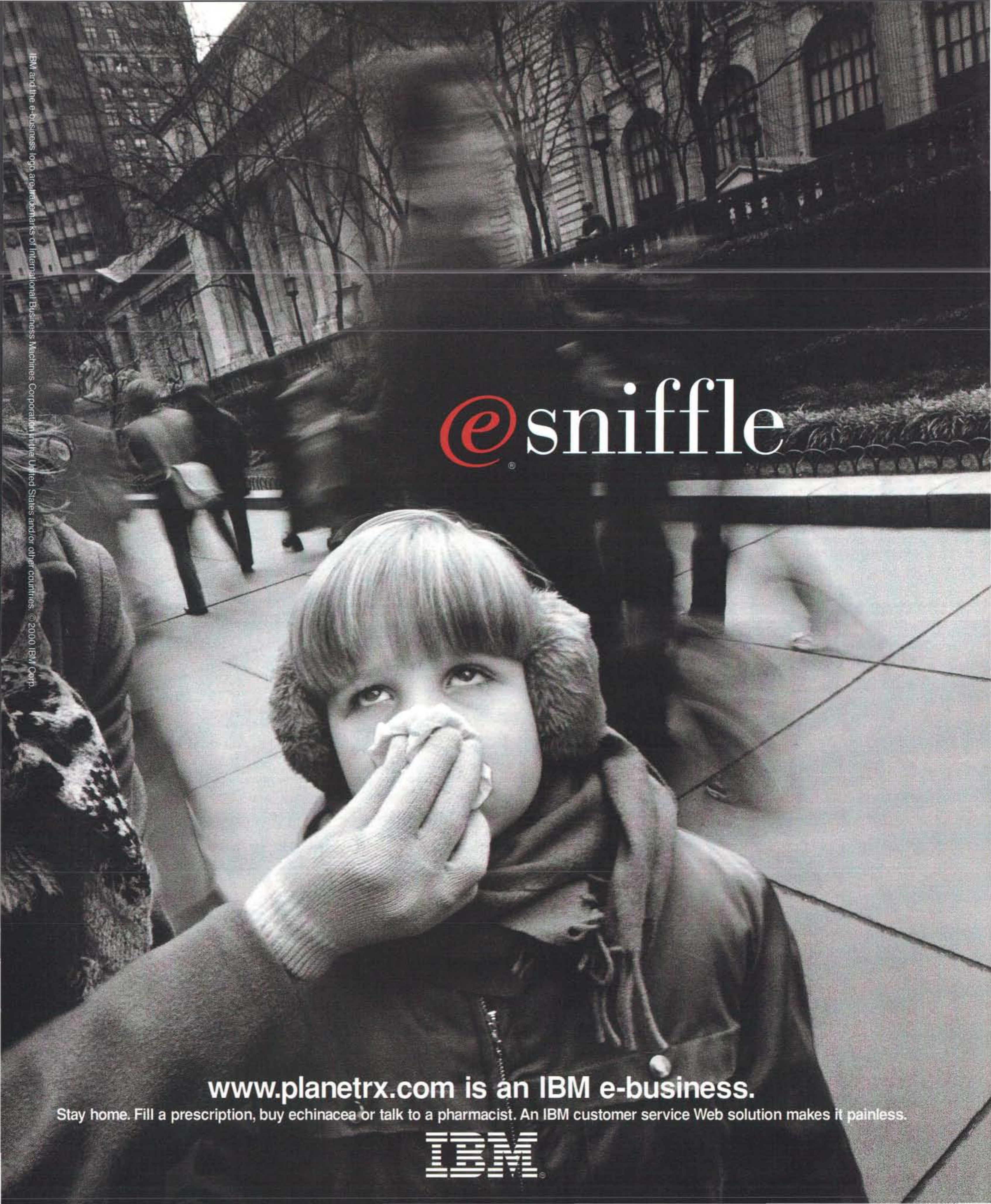
Thomas Mapfumo has revamped his sound by placing a trio of mbiras up front with the electric guitars, bringing the humble thumb piano's acoustic sound center stage. His politicized lyrics have earned him the name "Lion of Zimbabwe," but this album has decidedly international influences – "Zvichapera" delivers a reggae bounce, and "Kune Rima" echoes Congolese soukous with its swooping bass lines and short guitar-mbira riffs. The swirling rhythms, relaxed horn charts, and soulful call-and-response between Mapfumo and his backup singers give "Nhamo Zvakare" and "Chisi" simmering power. – *j. poet*



Steam

Real Time (ATAVISTIC)

Steam stretches the parameters of straight-ahead jazz with improvisational extravagance. Saxophonist (and MacArthur grant winner) Ken Vandermark maintains a strong sense of bohemian history, but his Chicago quartet resists the pull of nostalgia. Pianist Jim Baker supplies cerebral yet swinging structures, while bassist Kent Kessler and drummer Tim Mulvenna musically stalk the ever-expressive Vandermark.
– *Mitch Myers*



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HARDWARE

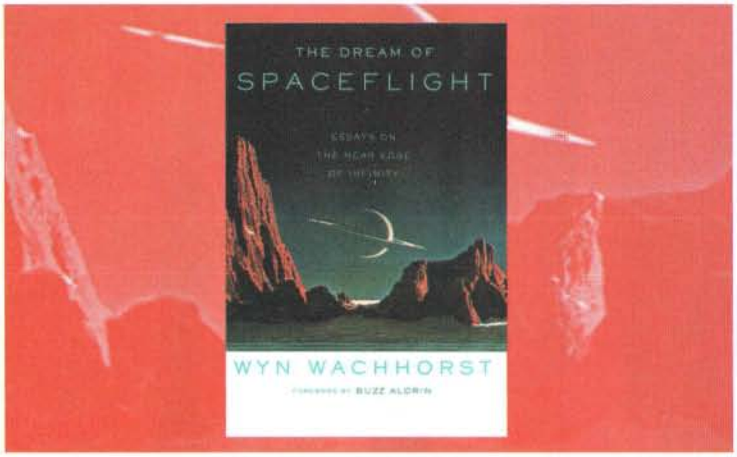
Cardiac Arrest

To be honest, listening to the ticker is a pretty low tech diagnostic technique. Just a couple steps up from urine-tasting, which I'm glad to say died out by the 19th century. But for a busy medical student, Agilent's new electronic stethoscope improves on the time-tested practice of auscultation.

Instead of picking up heart sounds with a diaphragm and transmitting them through an air-filled tube, Agilent uses a powerful microphone that relays cardiac signals to the earpieces. You can pump up the volume to zoom in on those subtle murmurs, without interference from frequencies outside the normal heart, lung, and bowel ranges.

Although the overall effect is like listening to a CD of your favorite cardiac rhythms, it feels much less intimate than using a conventional scope. Funny that being a step closer to the heart should make a difference, but it does.
– *Andrew Rozmiarek*

Agilent Stethos: $349. Agilent Technologies: *www.healthcare.agilent.com /mpgsupplies/stetscope.*



BOOK

Galaxy Quest

"When the 1994 Los Angeles earthquake knocked out the power in the middle of the night," Wyn Wachhorst writes in *The Dream of Spaceflight*, "Griffith Observatory received numerous calls asking whether the quake was responsible for the sky being 'so weird.' The city-bound callers had never seen a star-filled sky."

In this small but ambitious book, nearly equal parts celebration and frustration, Wachhorst cites this episode as emblematic of the modern world's estrangement from the cosmos – which, not so long ago, was the catalyst of romantic longings and noble aspirations. He seeks to draw our eyes skyward to view the heavens anew, as a starry field of dreams where humanity will – or at least ought to – find its destiny.

The current status of space exploration – what Wachhorst calls the "central project of our history" – drives him at once to distraction and to some of his liveliest and crankiest prose. He inveighs against those people and things ("muckraking journalists," "the liberal agenda," "cancerous individualism") that he holds responsible for the space program's unhappy and underfunded state. To deny the urge to explore, he thunders, is to deny "the primary force in evolution since the first water creatures began to reconnoiter the land.... The quest for the larger reality is the basic imperative of consciousness, the hallmark of our species."

Elsewhere, as he waxes lyrical on a range of space-related topics, the scent of nostalgia starts to waft. It's a nostalgia for the sci-fi future of the author's past, when Robert A. Heinlein's early novels, John W. Campbell's pulp anthology *Astounding Stories*, and George Pal's 1950 film *Destination Moon* lent wonder and escape to a generation of (mostly) adolescent boys. Wachhorst is especially eloquent on the great, if largely forgotten, space artist Chesley Bonestell, whose depictions of moons and planets wed gimlet-eyed astronomical authenticity with 19th-century landscape-painting Romanticism. During his heyday, in the 1940s and '50s, Bonestell's work seemed to make "the reality of spaceflight ... a foregone conclusion."

But of course it wasn't, and all those grand visions of humans astride the surfaces of other planets (and even our moon, after 1972) died in the wake of plummeting television ratings. Yet for all his exasperation with our terminally unimaginative civilization, Wachhorst thinks it's inevitable that humans will one day venture to the stars. And if that happens, he contends, a thousand years from now the moon landing will be seen as "the signature of our century" – just about the only thing the 20th century did that mattered. – *Jerome Clark*

The Dream of Spaceflight: Essays on the Near Edge of Infinity, by Wyn Wachhorst: $22. Basic Books: (800) 386 5656, *www.basicbooks.com.*

GAME

The City That Never Sleeps

Once you start, you simply can't put down the Palm version of *SimCity*. Although the game doesn't look as good as it does on a PC, it's actually more fun. The Palm becomes your Tamagochi as your virtual cities grow or fail even when the device is in your pocket. I found myself addicted, especially during one long coast-to-coast trip when Darrenopia was booming.

SimCity for Palm has all the tracking features, as well as city construction and planning issues that burden seasoned mayors. The downside is that you can see only a small sector of your city on the Palm's screen – you have to keep shifting around to check on the integrity of roads and power lines. Also, a simulated city won't evolve unless the program is live, so I had to adjust the Auto-Off setting to Max and press the On button when it timed out.

I found I could check my municipal statistics in sync with my flight check-in, boarding call, and seating. And it's more soothing to spend time in the air managing a made-up city than attending to the real challenges hiding in the Palm's To-Do, Expense Reports, or Calendar apps. After all, interest rates are more stable in the virtual plane. And if a tornado or a monster swooped down on my real life, I might actually be pissed, whereas on the Palm, it's just another day in the city. – *Darren Gladstone*

SimCity for Palm: $29.95. Atelier: +1 (612) 253 8400, *www.atelier.tm.*

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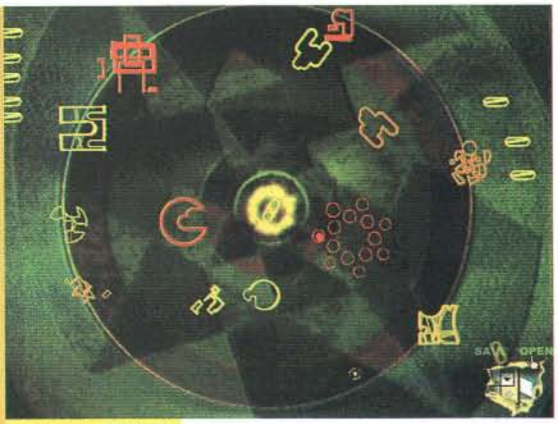
JUST OUTTA BETA



RELEASE: SUMMER

Harmonic Convergence

Noodle Party lets the dissonant masses jam together from their desktops. Logging on to the beta version via a point-and-click interface, I first expect pure cacophony. Instead, I join a mesmerizing four-person trance groove. Noodle Party is like sitting in with Afro Celt Sound System on IRC.

The application starts you in Noodle's main lobby. From here, I can select from a list of current sessions and participants, or launch my own. I choose a session called Nusrat – as in the late qawwali master Nusrat Fateh Ali Khan. My machine synchronizes with the host server, and a multicolored circle appears, representing the stage. Musicians show up as geometric animations surrounding a central sun graphic that stands in for the microphone. Then the music begins. I'm not literally playing notes, but I'm affecting the patterns and parameters of sounds that fit together no matter what I do.

By moving the animated instruments around and selecting from their ring-shaped pop-up menus, I can change volumes and choose different beats and tunes. Other players can see and hear these changes, so we all share the same group experience. I bask in the New Agey feel as other jammers fire up the Darbuka drums, flute, and sitar. For now, I'm hooked on Nusrat, though there are other choices, and more instruments and styles are in the works.

Noodle's not the only site you can go to for online music-making. There's Ikoino, a similar setup featuring psychedelic animations. Players collectively control the sights and sounds with gestures from a mouse or other input device; Ikoino creator Warren Stringer likens the groovy experience to group-dancing around a fire. Serious music producers can also use mH$_2$O.com, a \$2.99-a-month subscriber community that lets you mix and share with a huge library of music samples, open-source style, using proprietary versions of tools like Sonic Foundry ACID and Sound Forge XP. There's no real-time jamming, but studioheads and novices can find plenty of royalty-free mixing material and get their creations engineered at famous-name studios like Electric Ladyland at discounted rates. – *David Cohen*

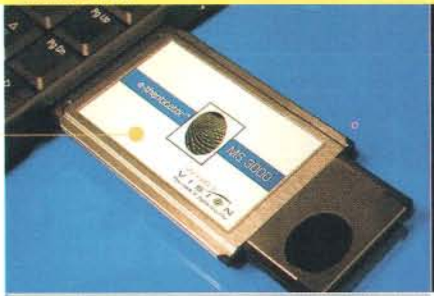
Noodle Party: *www.realworld.on.net/rwmm/noodle.*
Ikoino: *www.ikoino.com.*
mH$_2$O: *www.mh2o.com.*

Under My Thumb

Forget passwords! Now you can unlock your laptop with a fingerprint, thanks to Ethentica's hot-swappable PCMCIA card. The flat sensor pops out like a modem jack, and you respond to password prompts by touching the surface with your thumb. Unlike optics-only systems, the e-thenticator tests for the electrical properties of human skin, so a wax or metal cast won't fool it. The \$199 card's internal processor converts your thumb's loops or whorls into a unique 300-character profile, providing considerably higher security than passwords. – *Cate T. Corcoran*

Ethentica: +1 (949) 837 5353, *www.whovision.com.*

RELEASE: JULY

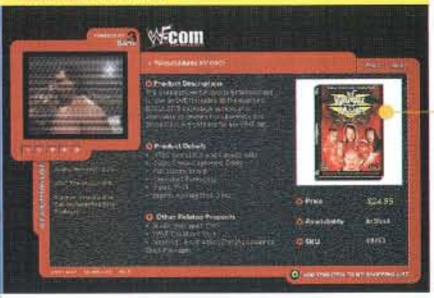


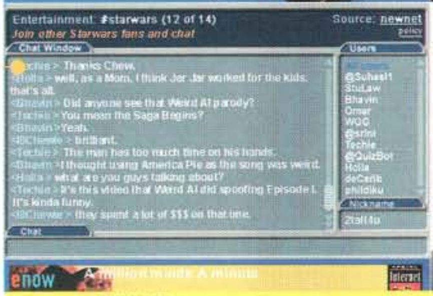
Marketing Muscle

The smackdown meets the pop-up, courtesy e-Media's BAM^3 system. While you're watching the Undertaker and other World Wrestling Federation combatants on pay-per-view webcasts, you can point and click on time-synced ads for related merchandise – think satanic pendants, sleeveless T-shirts, et cetera. e-Media is adding similar point-of-purchase punch to online broadcasts of Evander Holyfield and Oscar De La Hoya fights. – *Paul Spinrad*

e-Media: *www.e-media.com.*

RELEASE: SUMMER





Entertainment: #starwars (12 of 14)
Join other Starwars fans and chat
Source: newnet

Chat Window

<Techie> Thanks Chew.
<Holla> well, as a Mom, I think Jar Jar worked for the kids. that's all.
<Bhavin> Did anyone see that Weird Al parody?
<Techie> You mean the Saga Begins?
<Bhavin> Yeah.
<BChewie> brilliant.
<Techie> The man has too much time on his hands.
<Bhavin> I thought using America Pie as the song was weird.
<Holla> what are you guys talking about?
<Techie> It's this video that Weird Al did spoofing Episode I. It's kinda funny.
<BChewie> they spent a lot of \$\$\$ on that one.

Users
@Suhasl1
StuLaw
Bhavin
Omer
WGG
@srini
Techie
@QuizBot
Holla
deCerib
phildiku

Nickname
2tall4u

Chat

RELEASE: SUMMER

Listening Post

Feeling left out of the Great Conversation? eNow's ChatScan lets you power-eavesdrop on thousands of discussions, then drop right in the middle of the hottest talk in the ether. Enter a phrase – say, "molecular computing," or "Corey Feldman" – and ChatScan searches IRC channels and other community chat rooms to unearth all its appearances during the last five minutes. From there it's up to you and your fingerquips. – *Muffy Srinivasan*

eNow: *www.enow.com.*

RELEASE: AUGUST

Green Giant

One look at this lean clean driving machine will make other 4x4 drivers green with envy. The \$35,000 Acura MDX exceeds ultra-low emission standards for light trucks nationwide – there's no need for a special California version. A vapor-recovery gas tank reduces fume emissions at the pump, and the Alpine GPS navigation system eliminates the utter waste of getting lost – even off-road – by letting you save checkpoints during excursions in unmapped areas. – *Robyn L. Loda*

Acura: + 1 (310) 781 4655, *www.acura.com.*

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El Vez

X

Ben Folds Five

Steve Earle

Spacehog

Patti Smith

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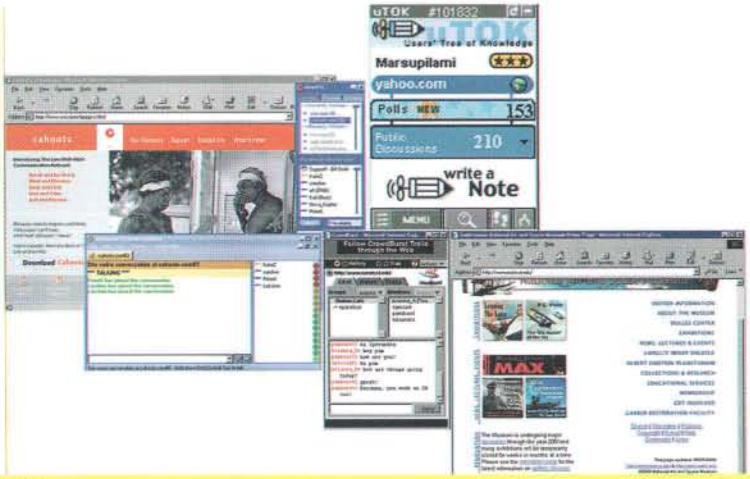
FILM

Atlas Shrugged

Part condemnation of a failing global economic system and part meditation on the deteriorating human condition, */dvac/particles.999/ddlrr* is a bold, harrowing vision from 18-year-old Kazakhstani director Gtron Sistem. This online-only English-language docudrama follows child prodigy Alexei, a Czech biological weapons scientist cut loose after the fall of the Soviet government. Cursed with intimate knowledge of covert projects, Alexei is rife with anxieties that blossom into paranoid schizophrenia, and then ultimately, self-mutilation.

Available only as streaming video, the constantly mutating resolution and ominous electronic score mimic Alexei's decaying mind. The film's weighty subject matter and impassioned tone are sometimes hard to take. Those who find the 93-minute stream too oppressive may opt for the shorter 10-minute installments at Undergroundfilm.com.
– *Scott Taves*

/dvac/particles.999/ddlrr: free. Viewable online at: *www.webactive.com/events-/particles.html* and *www.undergroundfilm.com.*



WEB

Noise "R" Us

Until recently, the only places to talk on the Web were dedicated chat sites. But a new breed of toy makes messaging webwide: Free programs like CrowdBurst, Cahoots, and uTOK let you leave notes anywhere or chat while cruising through sites, turning solitary surfing into collective critique.

The newer entries, CrowdBurst and Cahoots, offer both bulletin boards and live chat. With CrowdBurst, a Web-based Java app, you can lead other users from site to site; Cahoots, a PC download, offers roving Internet voice chat. Online stores are already beginning to use these tools to connect customers with live clerks, but both services are so new that the only people I chatted with were eager staffers at CrowdBurst and Cahoots. I suspect that once the systems catch on, both will become as chaotic and frustrating as typical chat rooms. Small, self-limiting groups with a specific agenda – like classes, businesses, or sets of friends – would probably find these programs most useful.

Since I couldn't find a browsing companion online, I called a friend, who obediently downloaded Cahoots. Before too long, we'd proved that it can be fun and useful: We cruised over to *www.georgewbush.com* and, using the voice chat, tried saying W's slogan to each other over and over: "A Reformer With Results." What sort of results does W routinely carry around – the day's results from the ninth race at Aquaduct? It's an awkward slogan, we decided. This discovery may never have occurred without the real-time communication.

The simplest app to use was uTOK – you just download and start dropping notes for others wherever you want. Communications can be private or public; the public ones can develop into a permanent discussion. It's similar to the service from Thirdvoice (*www.thirdvoice.com*), which debuted last year, except that uTOK lets users rate the posts of others in an effort to bring the best ideas to the top. In short, if this thing catches on, every site will have a self-regulated bulletin board.

As of yet, uTOK discussions have not appeared at many sites. A provocative note posted at CNNSI.com criticizing baseball player Pedro Martinez for his attitude toward have-nots was two months old. For real action, I had to go to the uTOK homepage, where the conversation was dominated by a fellow with something of a pottymouth. Others tried to use uTOK's voting system to have his notes evicted, but in the purely public arena it may be hard to maintain order.

I liked all three programs, though Cahoots was easiest to master and best lent itself to mature dialog, simply because it can host private chats and lead people to various sites. For now, you may not find smart new friends online, but you might get into some amusing conversations. – *Paul Chaplin*

Cahoots, CrowdBurst, uTOK: free. Cahoots: *www.cahoots.com.* CrowdBurst: *www.crowdburst.com.* uTOK: *www.utok.com.*

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Paul Chaplin, formerly a writer for cable TV's *Mystery Science Theater 3000*, is a producer of the online humor magazine *TimmyBigHands* (*www.timmybighands.com*).

Jerome Clark wrote the two-volume *The UFO Encyclopedia: The Phenomenon From the Beginning*, among other books.

David Cohen (*davidycohen@yahoo.com*) stays up late writing for various broadsheets from his penthouse in London.

Cate T. Corcoran (*cake@hooked.net*) writes about business, technology, media, and the culture of Silicon Valley.

Mark Dery is the editor of *ArtByte*, a magazine about digital culture. His latest book is *The Pyrotechnic Insanitarium: American Culture on the Brink of the Millennium*.

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Charles Platt (*cp@panix.com*), a frequent contributor to *Wired*, writes science fiction books and science articles. His most recent work is *The Silicon Man*.

j. poet (*poebeat@earthlink.net*) writes about world music and pop culture for a variety of publications from a pink Victorian flat in San Francisco.

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Tessa Rumsey's book of poems, *Assembling the Shepherd*, was published in December 1999.

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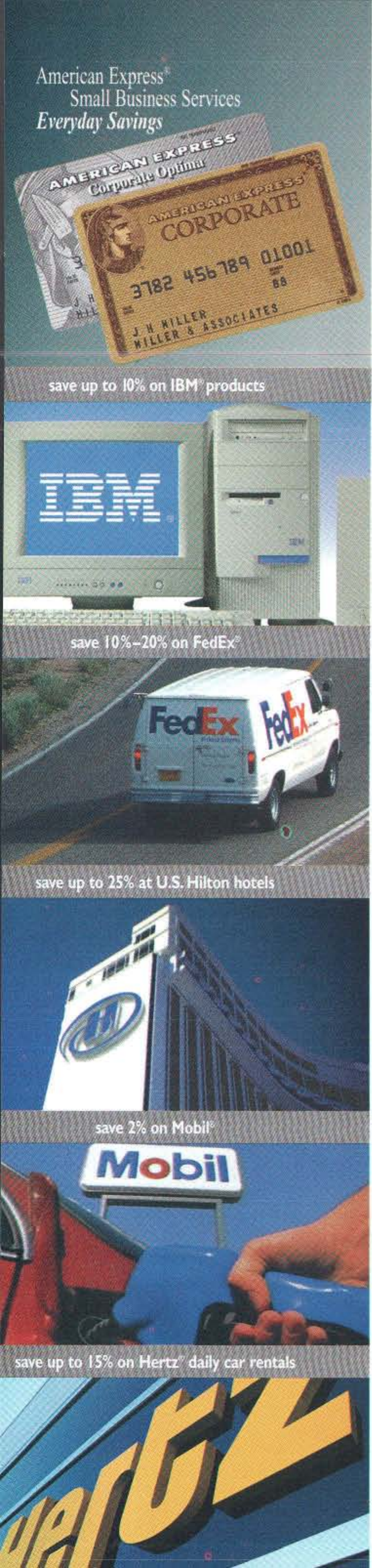
Philip Van Vleck (*pvv@bellsouth.net*) covers pop music and theater for *The Herald-Sun* (Durham).



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EarGlove

FIRST CLASS:

Plantronics M130

Want your hands free for all your other handheld devices? Wireless headsets help keep your cell phone in its place, letting your digits take care of higher-level parallel processing. The blue-purple Plantronics M130, with its small, noise-canceling boom mike, easily tops the other models tested for sound clarity at both ends of the call. Comfortwise, the earbud is pleasantly light but a bit large; those with small ears might prefer the hook (included), especially if they tend to power-walk – and talk – recklessly.

M130: $44.95. Plantronics: (800) 544 4660, *www.plantronics.com*.

BUSINESS CLASS:

Jabra EarSet

Jabra's groundbreaking one-piece design packs both microphone and speaker in your ear: The tiny unidirectional mike perches just outside the earpiece, leaving nothing but wire trailing down to your phone. A boom- and clip-on-free existence means you'll feel less like Lily Tomlin's Ernestine, but this clearing of clutter does mean a sacrifice in sound quality at the other end. Soft earbud covers come in an assortment of sizes.

EarSet: from $39.95. Jabra: (800) 327 2230, *www.jabra.com*.

COACH:

GoNeo EarGlove

The official licensee of wetsuit maker Body Glove, GoNeo shows its roots with a snug-fitting neoprene-like foam sleeve covering the mike boom and ear hook. Like the M130 and the EarSet, EarGlove comes in a range of models for a variety of phones, and low-cost adapters will make the standard 2.5-mm plug model fit anything. EarGlove's mike doesn't cancel noise, but the headset's snazzy colors (yellow, black, blue, or purple) mean you'll stand out for more than waving your arms in public.

EarGlove: $24.95. GoNeo: (888) 383 7999, *www.goneo.com*.

Body Fat Analyzers

Body Comp Scale

FIRST CLASS:

Health o meter Body Comp Scale

Face it: It's not a weight problem, it's a fat problem. Still, the Body Comp measures both, and tracking your numbers can get as addictive as, well, eating. Step up, enter your height, sex, and activity level, then grip the hand contacts. The device sends a tiny electric current through your body to measure resistance, then displays your weight along with estimated fat ratio and body water percentage. The included inkjet printer produces a report that compares your stats with the norm and gives you target ranges.

Health o meter Body Comp Scale: $3,500. Sunbeam: +1 (708) 598 9100, *www.sunbeam.com*.

BUSINESS CLASS:

Tanita TBF-551 Body Fat Monitor/Scale

Built like a regular bathroom scale, Tanita's TBF-551 sends its fat-ferreting electricity through your bare feet via two shiny electrode footpads. Then your weight and body fat ratio (but not your body water ratio) take turns flashing on the display. By punching in your height, sex, and body type (Athlete, Adult, or Child), you can program the scale for up to four users – tap your button before you step on, and the scale will know it's you.

TBF-551 Body Fat Monitor/Scale: $139.99. Tanita Corporation of America: (800) 826 4878, *www.tanita.com*.

COACH:

Omron Body Logic HBF-301

Omron's Body Logic won't measure your weight: You have to punch that in before you begin. But with this loss in scale-ability comes a gain in portability – the 20.8-ounce device is perfect for a foie gras tour of the Dordogne. Like the Body Comp, it sends current through twin handholds; using older estimation methods, the HBF-301 may be less accurate in absolute terms, but it's consistent, which makes it great for tracking when the goose is getting fat.

Body Logic HBF-301: $99. Omron Healthcare: (877) 216 1333, +1 (847) 680 6200, *www.omronhealthcare.com*.

Metal Detectors

CZ5 Quicksilver

FIRST CLASS:

Garrett GTI 2500

Like other metal detectors, Garrett's GTI 2500 senses perturbations in an electromagnetic field. But thanks to a DSP chip and redesigned deep-imaging search coil, this infinitely flexible hunter-gatherer also gives you a visual read on target size and depth – to help you distinguish soda cans from cannonballs *before* you start to dig. Information reads out on the backlit screen, or comes to you verbally via "Treasure Talk" voice notification, breaking into your prolonged, wordless solitude.

GTI 2500: $1,099.95. Garrett: (800) 527 4011, *www.garrett.com*.

BUSINESS CLASS:

Fisher CZ5 Quicksilver

The water-resistant CZ5 beats all comers when it comes to beachcombing – the Quicksilver's wet-sand mode lets you work the edges of the surf without getting false signals triggered by salt minerals. Depth and probable target identification – by metal, from aluminum to zinc – appear on the metered display, and the audio boost amps up weak signals from booty buried down deep. Quicksilver is easy for beginners to use, yet offers enough flexibility for treasure-crazed snowbirds and other hardcore scavengers.

CZ5 Quicksilver: $849.95. Fisher Research Laboratory: +1 (209) 826 3292, *www.fisherlab.com*.

COACH:

Tesoro Bandido II µMax

Like metal detectors of yore, Tesoro's Bandido relies solely on tone and a sensitive ear. But the all-analog µMax trumps the old guard with its All Metal or Discriminate operating modes; while any blip on a battlefield may be worth pursuing, you'll likely want to tune out the pop tops on the seashore. The manually adjustable ground balance means better sensitivity in iron-rich soils, keeping you hot on the scent of that Civil War relic.

Bandido II µMax: $469. Tesoro Electronics: (800) 528 3352, +1 (520) 771 2646, *www.tesoro.com*.

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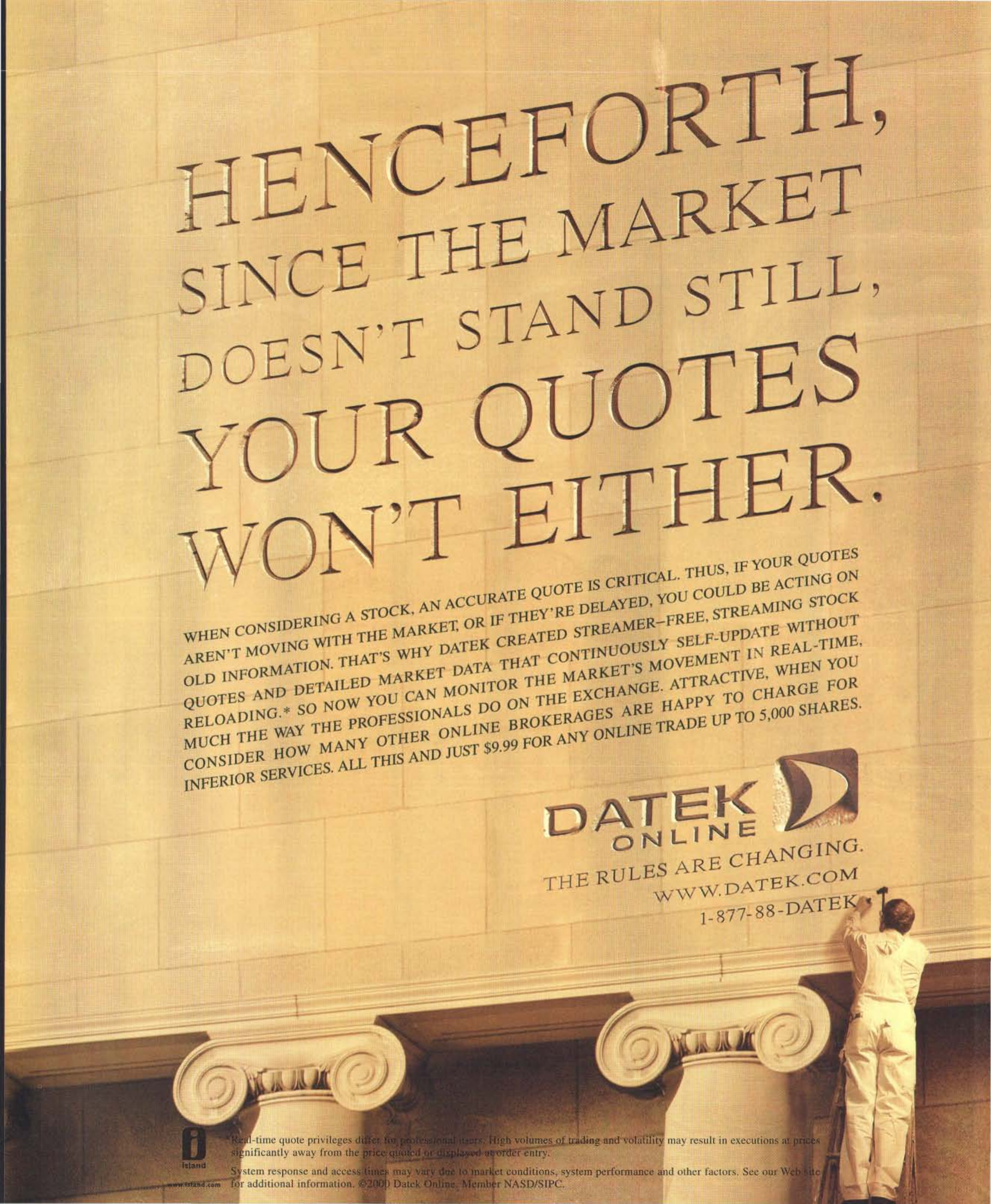

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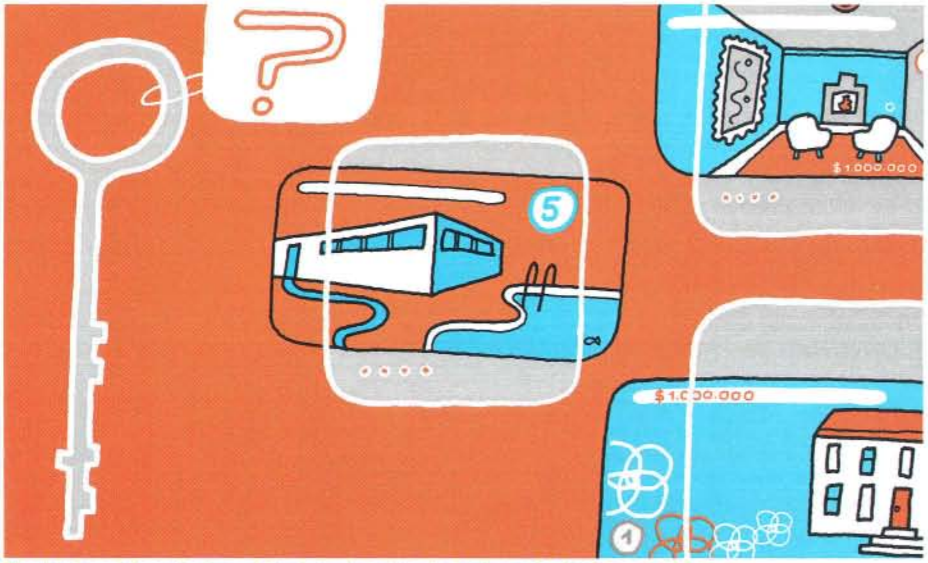
Real Estate

Remodeling a Business Monopoly

In April, Homestead.com heard a loud knock on the door: It was the DOJ's Antitrust Division. The house-hunting portal operates an array of sites, among them Realtor.com, official site of the National Association of Realtors. What piqued the DOJ's curiosity, it seems, was Homestore.com's effort to keep the multiple listing services (MLS) – for-sale listings compiled by the NAR's 1,600 local Boards of Realtors – to itself.

Since the 1960s, MLS data has been closely guarded by realtors. "The old-school way of real estate was we had the listings," says Ray Burke, an agent with RE/MAX in Tallahassee, Florida, and former director of the Tallahassee Board of Realtors. "Consumers needed to come to us to get that information, so we had control of the market."

But as more house hunters have turned to the Web – up from 2 percent in 1995 to 37 percent in 1999, according to the NAR – local boards have been licensing their MLS listings to independent Web sites like Homeseekers.com. Homeseekers generates leads for agents via customizable pages and tracking tools, and also lets prospective buyers search listings according to a variety of criteria. The site was the first indie to obtain the right to distribute local MLS data in 1995, and now most of its 850,000 listings are based on MLS data.



The National Association of Realtors is losing its lock on the listings market.

Homestore.com, meanwhile, has aggregated 1.3 million listings on Realtor.com, offering its stock to local boards in return for exclusivity. Corralling all listings into one NAR-sanctioned site, says chair and CEO Stuart Wolff, ensures quality and simplifies the lives of agents and buyers.

But Homestore.com's lock on the listings increasingly doesn't sit well with agents. "We're paid to market property, and we need to list it in as many places as possible," Burke argues. A growing number of local Boards of Realtors are breaking ranks, making their listings freely available. Even when a board signs exclusively with Realtor.com, more and more disgruntled agents are taking their own listings to competing sites.

NAR president Dennis Cronk grasps the trend. Agents must evolve, he says, from keepers of sacred data to guides through the labyrinth of buying a home. What remains to be seen is how the NAR will adjust to the newly networked maze. – *Rick Overton* (riverton@mindspring.com)

Homestore.com: *www.homestore.com.*
Homeseekers.com: *www.homeseekers.com.*

ILLUSTRATION: SUSANNE SAENGER

Investment Club

Breaking the Waves

While the rabble sifts through endless posts on online message boards, where do the geeks look for hot stock tips? Tobin Smith's ChangeWave Alliance. "It's the Motley Fool on steroids," says Peter Horst, head of marketing at Net security firm ICSA.net and a ChangeWaver since July 1999.

Smith, VP of Internet development at Phillips International (with which he co-owns ChangeWave), calls his approach "open source investing." Since 1995, he has cultivated a coterie of roughly 1,000 informants who contribute tips in return for Smith's buy/sell/hold recommendations. Smith claims a 513 percent return in 1999 and 1,700 percent over the past five years.

ChangeWave began "as a hobby," Smith says, but now he wants to move beyond word of mouth. Membership, which remains invitation-only (candidates must be sponsored by a current member), costs $120 annually for all Alliance correspondence plus special-topic reports. Buy/sell/hold recommendations and portfolio management are available to nonmembers for $295 a year.

Smith accepts two kinds of tips, both of which are necessary to define a valid opportunity. A "changequake" is a new development, such as the SEC's decision to allow banks and brokerages to send statements via email. A "changewave" is a new product that takes advantage of a new development, such as Tumbleweed's certified email system.

Even after he has vetted the tips and settled on a promising stock, Smith won't recommend a company unless it meets three criteria: Its annual growth rate must be in the top 10 percent within its sector, its sector's growth rate must be in the top 10 percent within its industry, and its industry's growth rate must be in the top 10 percent among high tech industries. Tumbleweed made the cut and paid off handsomely, appreciating from $18 to $75 per share during the six months Smith advised holding it.

Although ChangeWave was developed for picking stocks, Smith believes his method is useful for evaluating any kind of information that's highly fragmented and thinly distributed. "In our case, it's buy, sell, or hold," he says, "but it could be anything. This is a superior decision-making model."

– *Michael Kaplan* (mkaplan2000@aol.com)

ChangeWave: *www.changewave.com.*

NEW MONEY

Social Capital

Mutual Responsibility

What's the latest metric for return on investment? Good corporate behavior. Proponents of socially responsible investing (SRI), like Domini Social Investments, belie the conventional wisdom that there's a cost to supporting values other than the bottom line, while the SEC may soon make it easier than ever for investors to separate good behavior from the bad and the ugly.

According to the Social Investment Forum, a nonprofit association, SRI grew at twice the rate of all assets under management in the US between 1997 and 1999. Socially responsible mutual funds have increased in number from 55 in 1995 to 175 in 1999, and in aggregate from $12 billion to $154 billion – and these funds were twice as likely as non-SRI funds to earn Morningstar's top rating last year.

Domini's Social Equity Fund, which recently reported an average annual return of 30.2 percent, tracks the Domini 400 Social Index, a group of US companies screened for involvement with alcohol, tobacco, gambling, military weapons, and nuclear power. Qualitative screens bear on community, diversity, employee relations, environmental impact, international labor, and product quality.

So can SRI change the world? Definitely, says Domini Social Investments founder Amy Domini. "In South Africa in the 1980s," she recalls, "the way we invested brought about change." Since then, SRI has impacted R. J. Reynolds' marketing strategy, Nike's labor practices, and, more recently, Home Depot's sale of old-growth timber.

"Environmentalists had been working on Home Depot for years," says Social Investment Forum director Steve Schueth. "Investors filed a shareholder resolution last year, and within six months the company agreed to this deal. We've never won one of these resolutions in a vote, but we can make a strong statement to the board of directors."

Domini's fund was the first to publish its votes on shareholder resolutions online, but the SEC is considering a new rule that will require all funds to post their proxy votes to freedgar.com. "If you saw that your fund was voting against environmental responsibility, you'd switch funds," Domini says. "It will change the way large financial institutions vote and, by extension, the way companies are run." – *Amanda Griscom* (agriscom@feedmag.com)

Domini Social Investments: *www.domini.com.*

The Wired Index

The New Mconomy

People talk about mobile commerce as though it's the Second Coming of the Internet, and it sure looks as though wireless transactions will deliver convenience that most of us, tethered to cumbersome boxes and insufficiently reliable ISPs, can only dream about. But this is just the beginning. If the next wave is mcommerce, the ocean is mbusiness.

Just as ecommerce pushed companies to connect customers, internal operations, and external suppliers, so mcommerce will drive investments inside and outside the mobile enterprise. Mbusiness will happen when machinery on the plant floor in Guadalajara notifies you instantly of a problem, even though you're fishing from a dock in Myrtle Beach; when a shipping container in Manila reroutes itself in response to a message from a shipping network; when you walk into an office and the computer in your pocket automatically identifies you to the local network.

The Wired Index companies that stand to benefit include those that provide infrastructure (Cisco, Globalstar, Vodafone, WorldCom) or furnish decision-making content (America Online, Schwab, Reuters). But the greatest opportunities lie in real-time transaction services – gathering data, organizing it, and delivering it where it can do the most good. Several recent WIRX additions sit right in this sweet spot – BroadVision, i2, and Oracle – as well as WIRX old-timers First Data, Schlumberger, State Street, and FedEx.

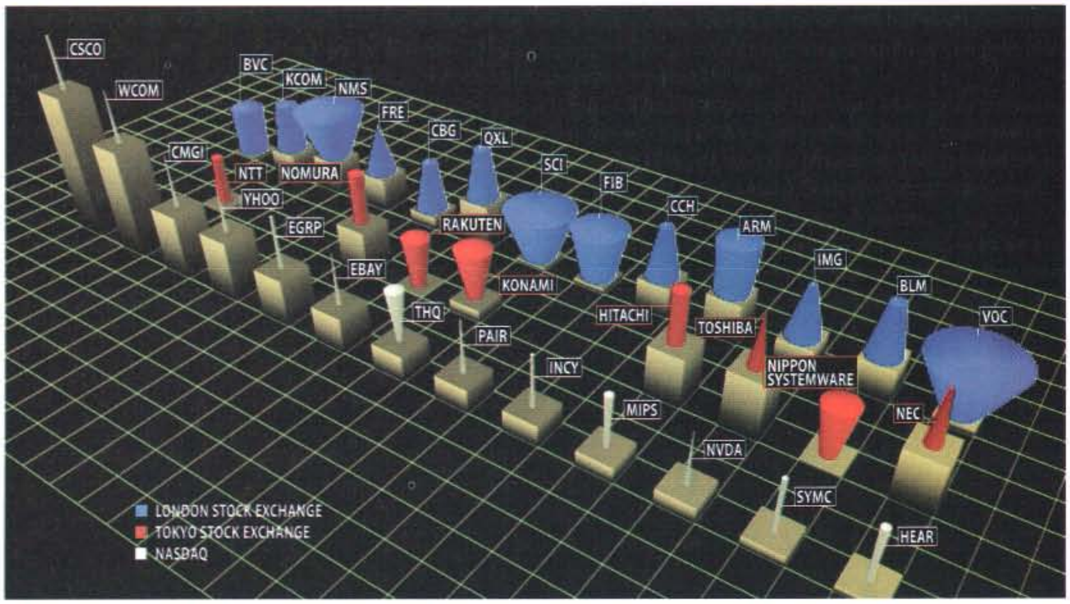
It's all about getting machines in homes, stores, offices, and factories – and in between – working together systematically and proactively to serve real needs. Then all business, not just end-user transactions, will be mbusiness. – *Phil Hood* (phood@actnet.com)

INDEX PERFORMANCE (as of 6/1/00)

Name	Since 11/30/95	Previous 12 Mos.	YTD
WIRX	+420.64 %	+43.76 %	–0.48 %
Nasdaq Composite	+221.08 %	+37.66 %	–16.43 %
Dow Jones Industrials	+107.36 %	–0.35 %	–8.48 %

The Wired Index tracks 40 public companies selected by editors of *Wired* to serve as a bellwether for the new economy. For a complete description and the latest results, see *stocks.wired.com.*
Data courtesy Bloomberg Financial Markets.

Fine Points



In May the London Stock Exchange, the grandam of capital markets, announced plans to wed her young German boy toy, Frankfurt's automated Deutsche Börse. Why this urge to merge? An automated exchange can provide lower spreads between bid and offer prices, which helps increase trading volume.

The image shows that low spreads and high volume go hand in hand. It depicts a selection of roughly comparable companies from the London, Tokyo, and Nasdaq exchanges as cones. The base radius of each cone reflects the average spread percentage on its exchange: 4.0 (London), 1.7 (Tokyo), and 0.5 (Nasdaq). The top radius is the company's own spread, which ranges from 0.06 (YHOO) to 10.2 (VOC). The height of the pedestal represents trading volume. In this group, Nasdaq has the lowest spreads and the four highest-volume stocks.

Nasdaq's automated efficiency is attracting traders throughout the world, unleashing what promises to be a wave of consolidation in Europe. Although Tokyo's arcane system gets better results than London's, with the June rollout of Nasdaq-Japan, wedding bells may soon be ringing there as well. – *Clem Chambers* (clem@on-line.co.uk)

ILLUSTRATION: CLEM CHAMBERS AND ALEX ST. LOUIS, ADVFN.COM PLC (*WWW.2C2C.COM*). TOKYO DATA COURTESY JIJI PRESS.

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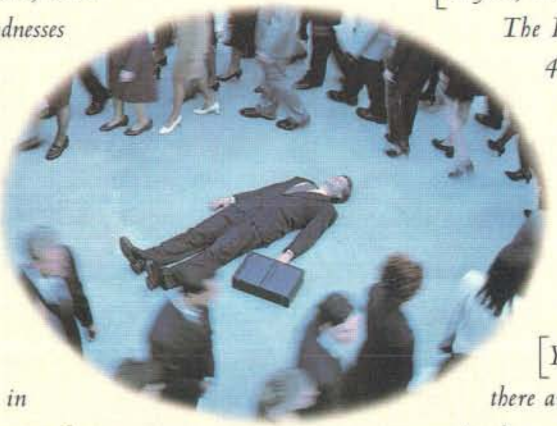
1 K

"Those who can't KEEP UP with the pace will just have to fall by the wayside."



∞ A spirited point of view! One steeped in fortitude, grounded in character, and in line with the unblinking discipline required for success. It's a shrill tone, albeit lacking in the small kindnesses and considerations that keep the good people. And isn't that one of the goals? Once you have that precious handful of employees who willingly and aggressively join you in your cause, you do want them to stay with you, don't you? ∞ In the world of employee incentives, here's a new thought. impact401k.com. It's easy to enroll in (simply log on), has features comparable to plans reserved for much larger companies, and it's empowered by the Principal Financial Group.® [In fact, more employers choose The Principal® for their 401(k) plans than any bank, mutual fund or insurance company.] ∞ Yet, we think you'll find the cost quite easy to take. [You do it yourself, so there are no sales charges, nor is there a penalty should you choose to leave the program.] ∞ And your employees? The ones you like? With a 401(k), they'll stay. Despite the grueling pace.*

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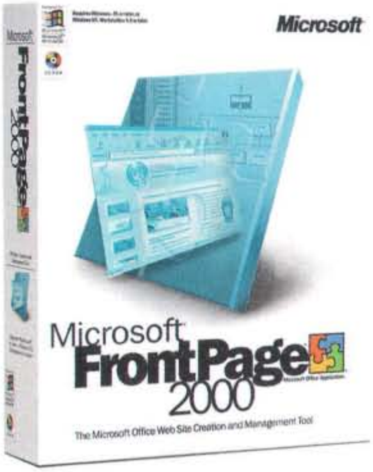

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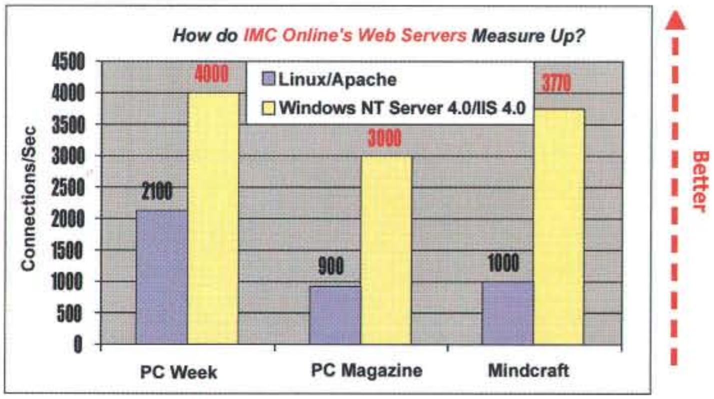

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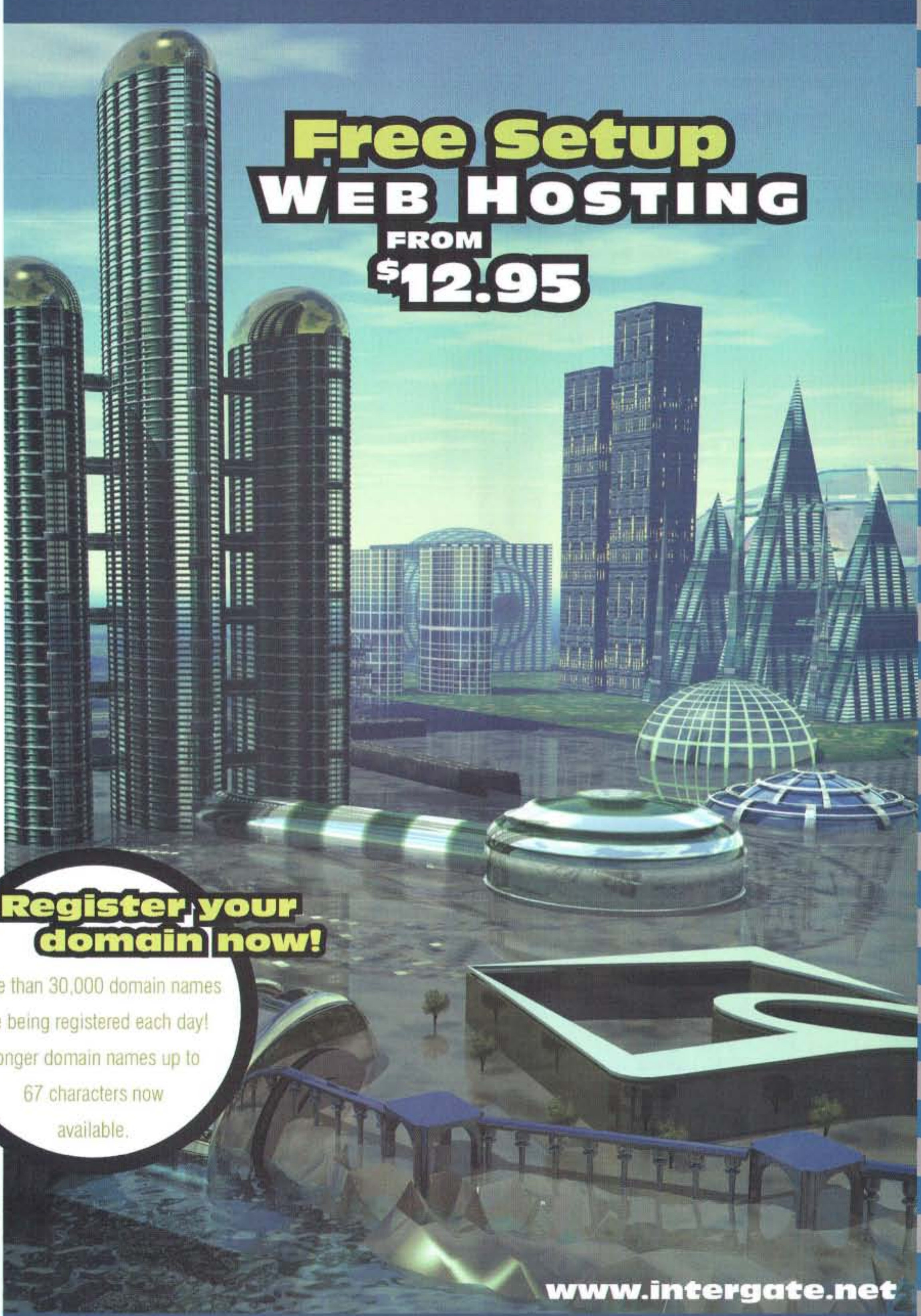

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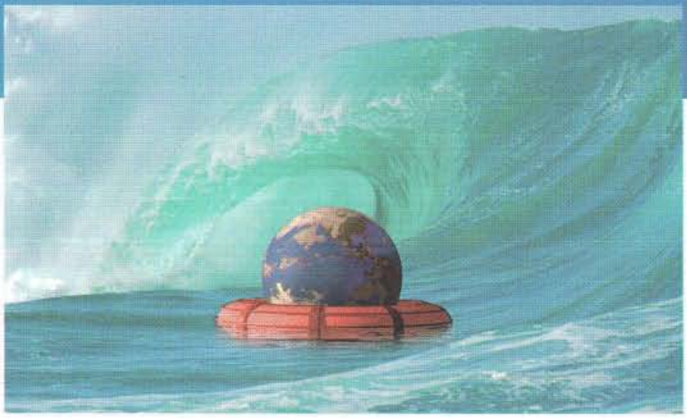

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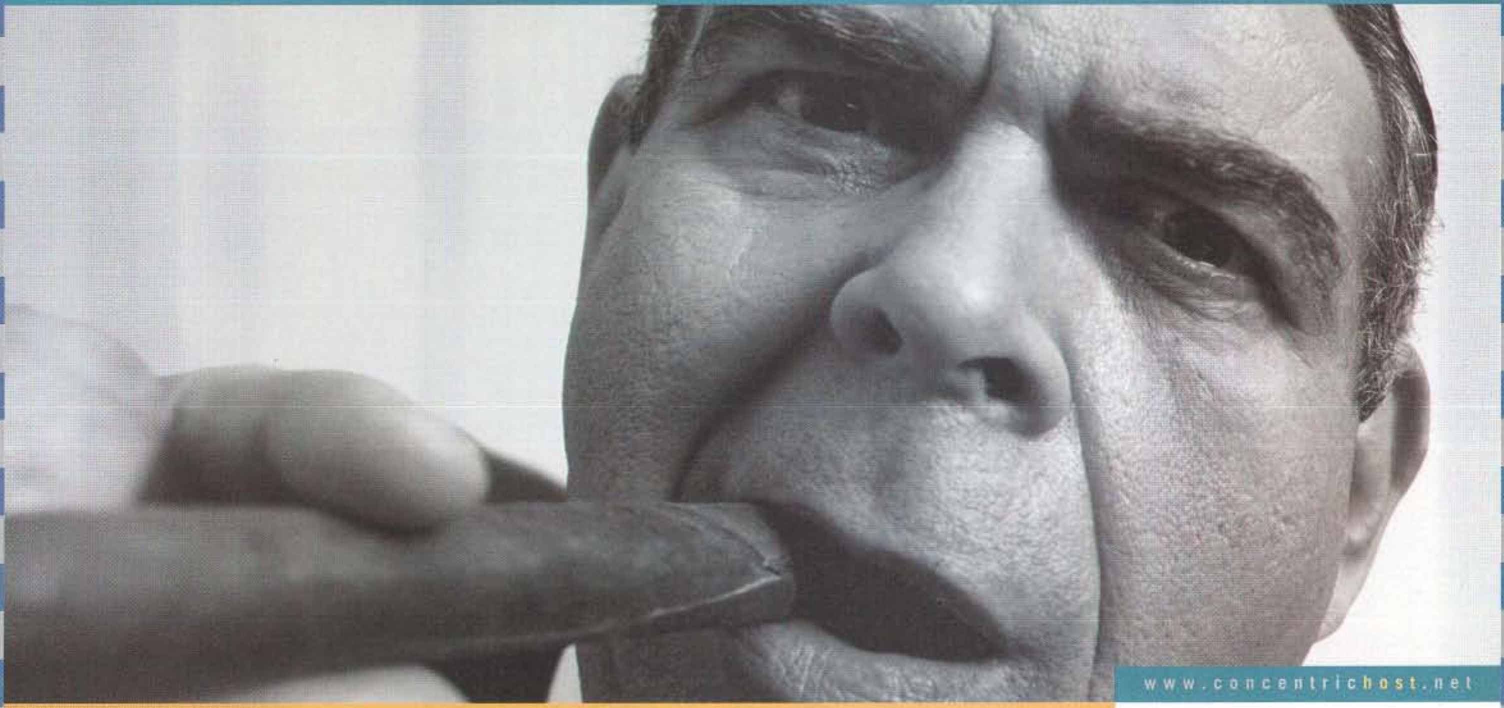

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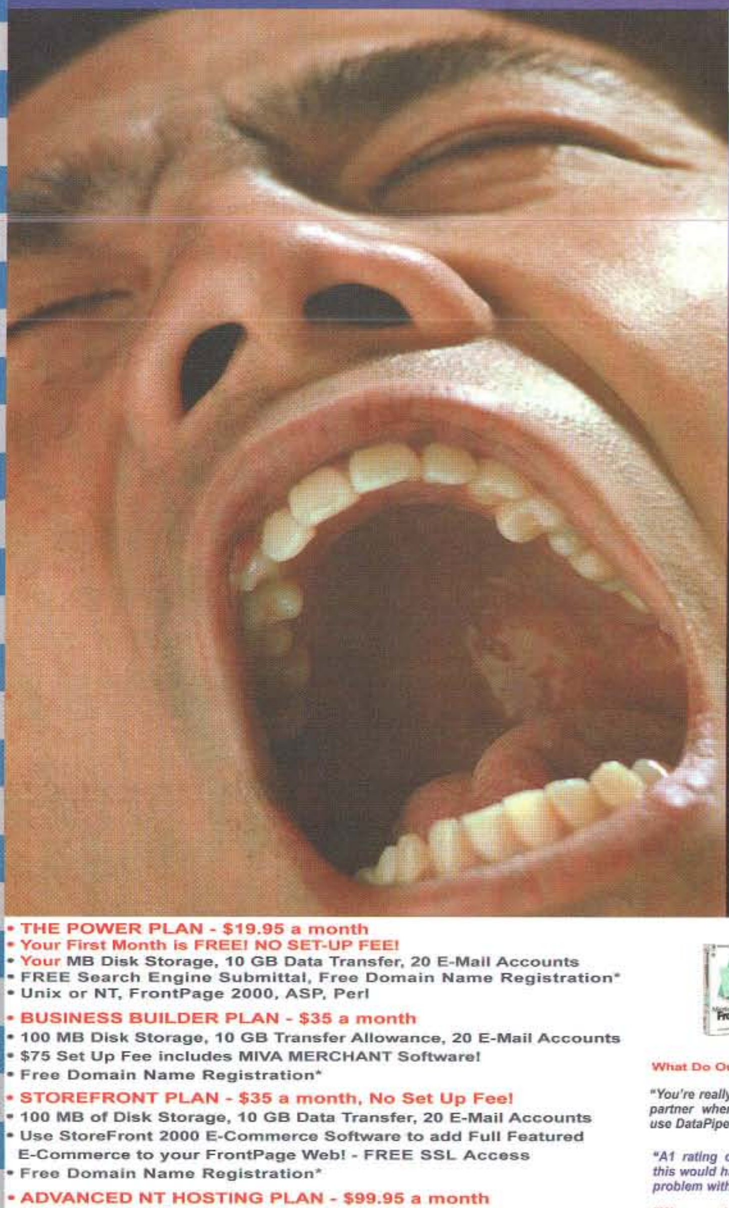

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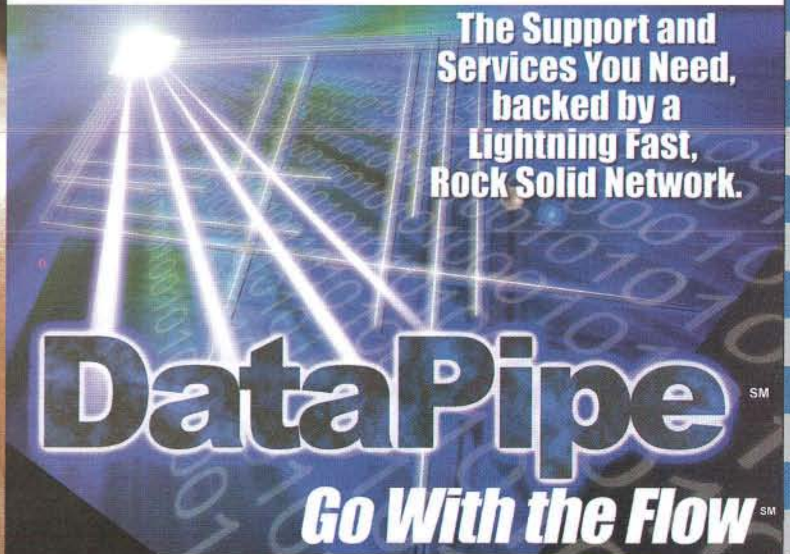

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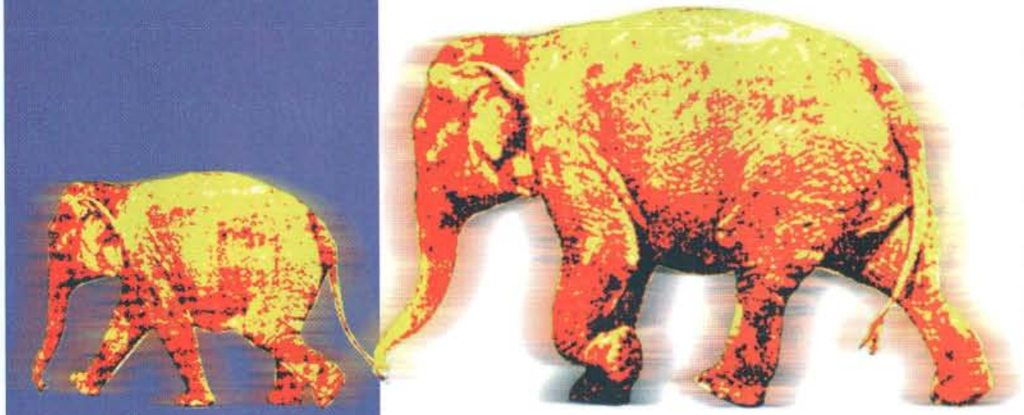

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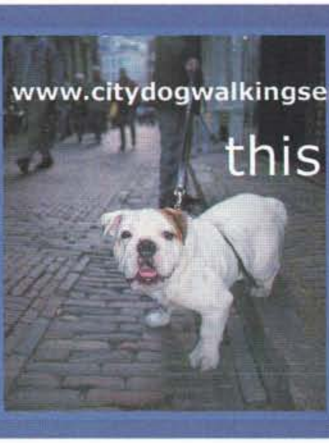

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Sources: 1998 Subscriber Study, Intelliquest Business Influencer Study v5.0

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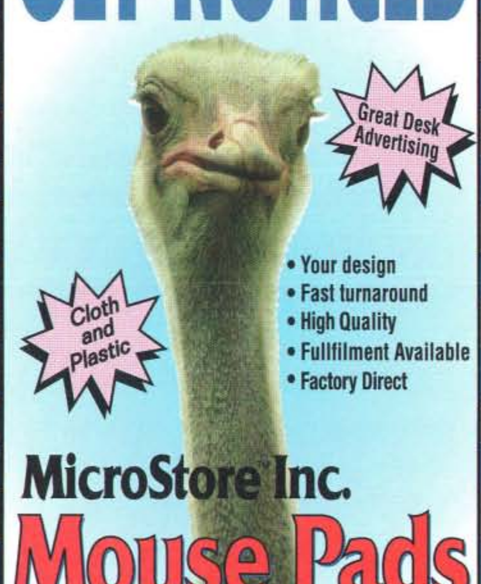

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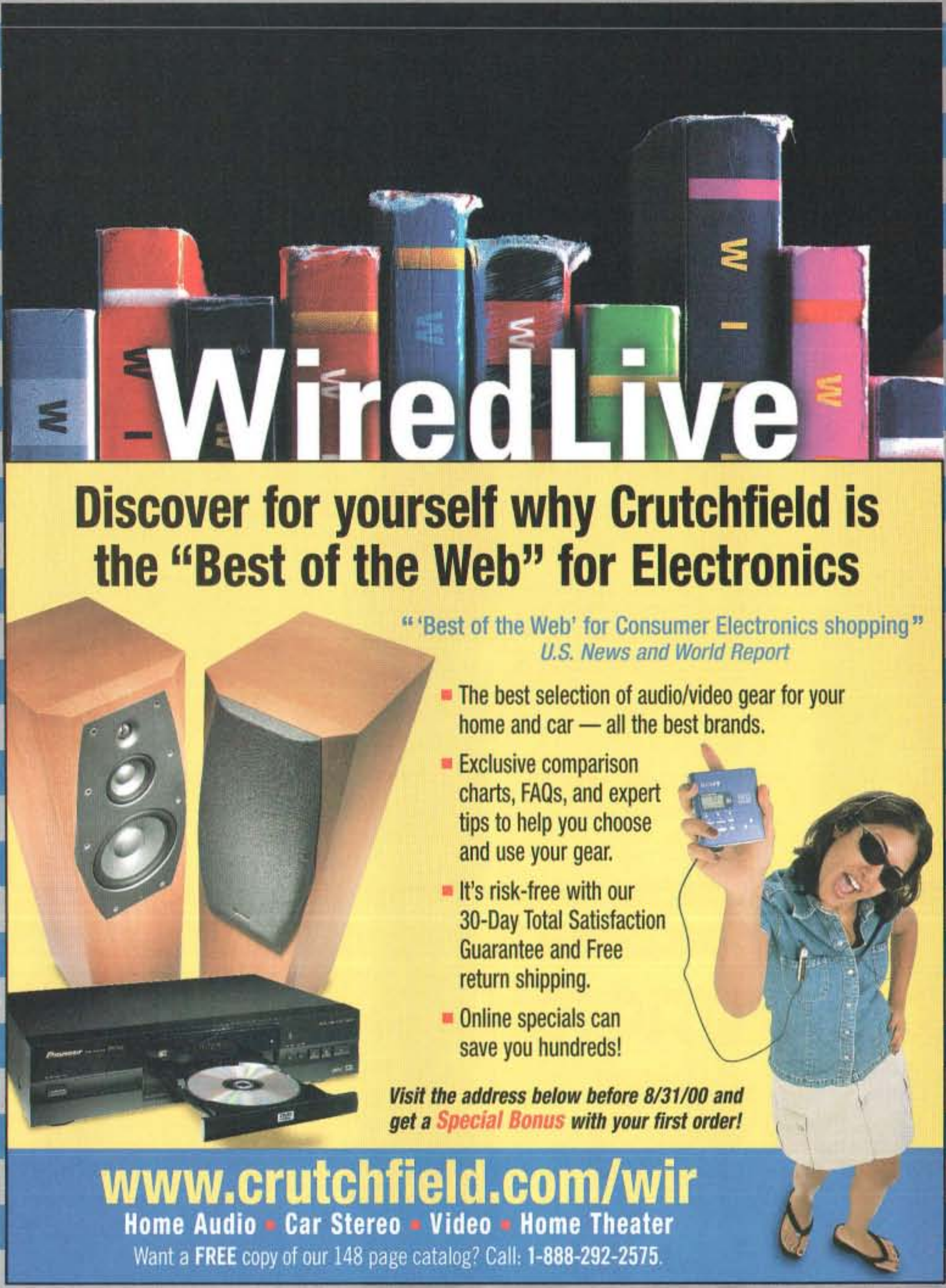

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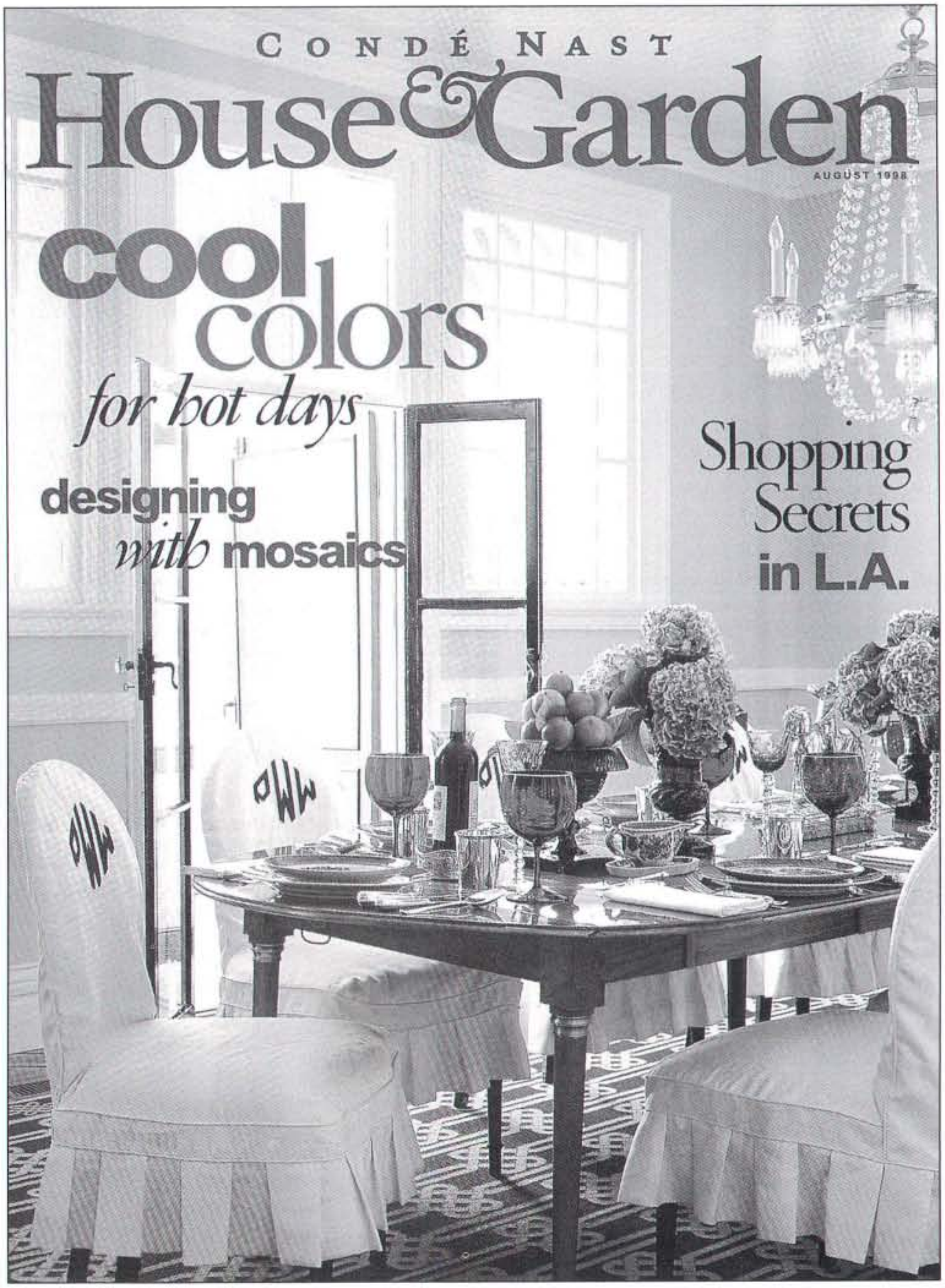

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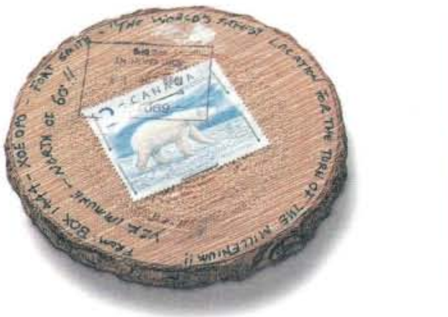

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(See page 43.)

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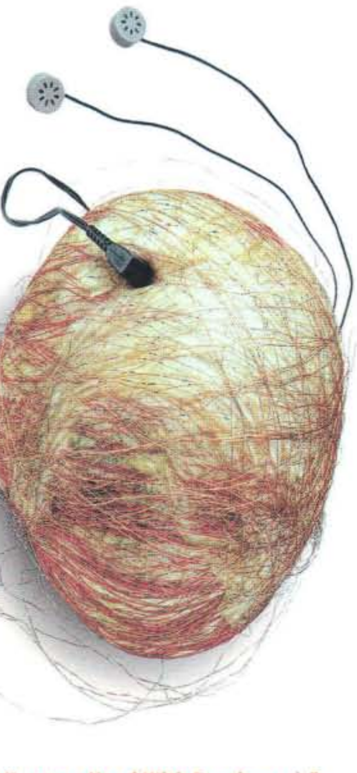

"Untitled (Lettuce Head With Earphones)," by Joel Fletty.

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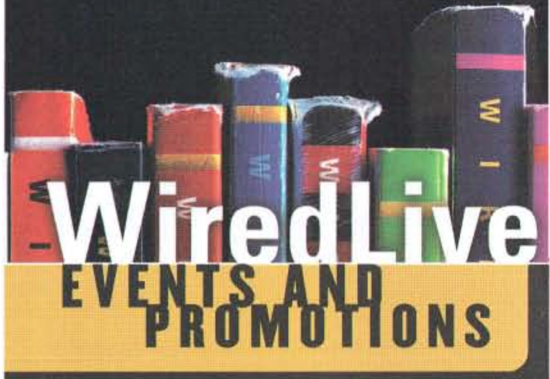

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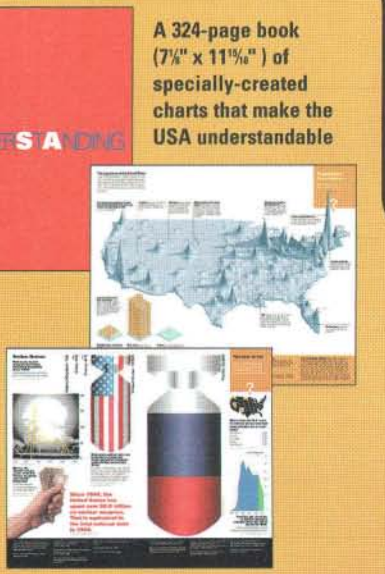

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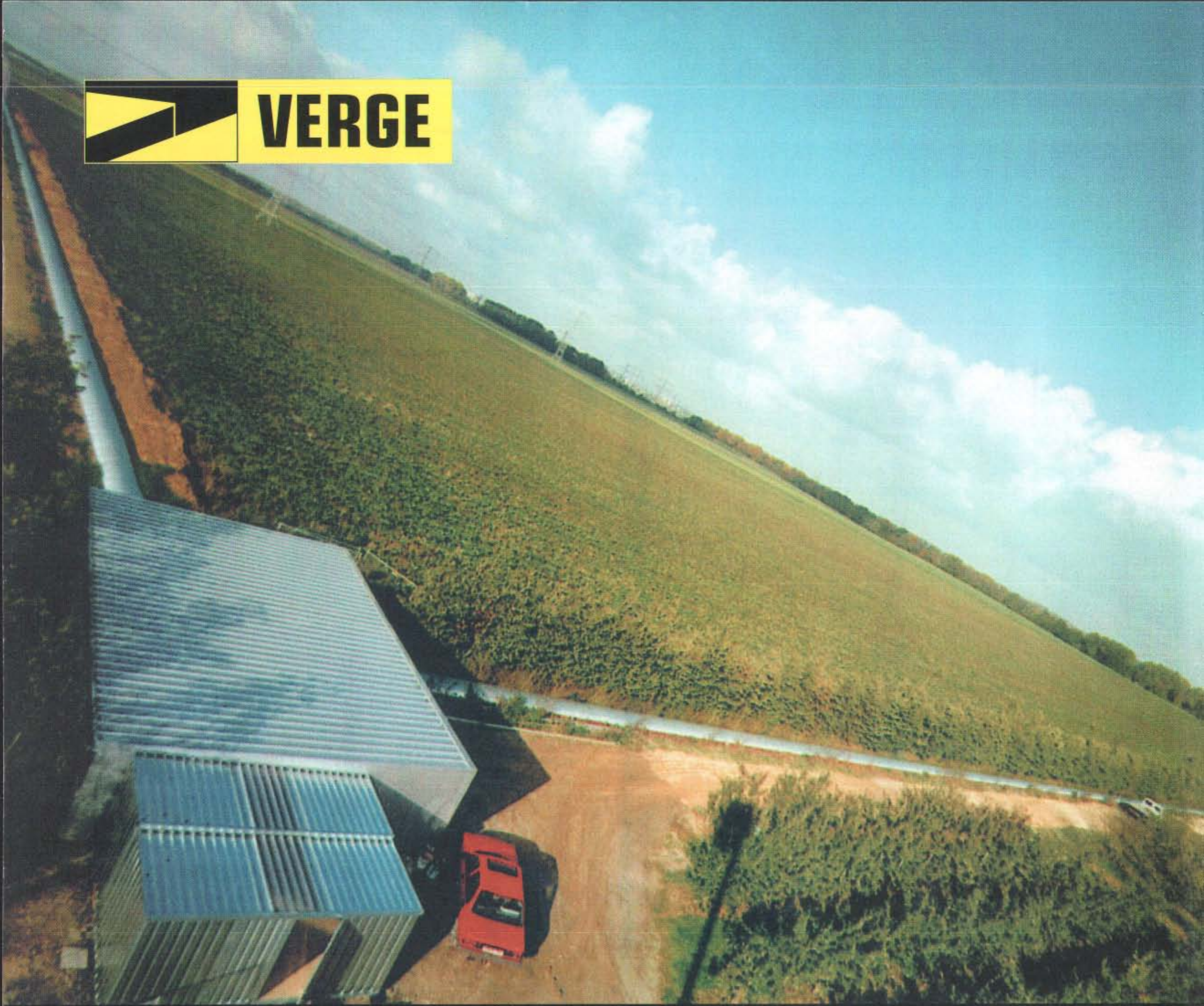

WHAT:	GEO 600 laser interferometer
WHERE:	Hannover, Germany
WHY:	To measure gravitational waves predicted by Einstein's general theory of relativity but yet to be observed. These waves – space-time ripples caused by the movement of large cosmic masses like black holes and compact binary stars – will help determine distances across the universe. This data will be critical in fixing the Hubble constant, a number long sought in cosmology and key to gauging the universe's rate of expansion.
WHO:	University of Hannover, University of Glasgow, Max Planck Institute, Cardiff University, Albert Einstein Institute
HOW:	A neodymium-doped yttrium aluminum garnet laser beam, fired from the corner station, bounces back and forth twice along each stainless steel arm of the L-shaped facility. Because the arms are identical – tubes 600 meters in length and 60 cm in diameter – the beams should traverse both in exactly the same amount of time. Any variations (measured by a photodetector) indicate that the tubes' length was temporarily altered by a gravitational wave. The GEO 600 is due to start test operations sometime this summer. Results will be correlated with data from partner sites in the US, Italy, and Japan, helping identify the precise celestial sources of gravitational waves.
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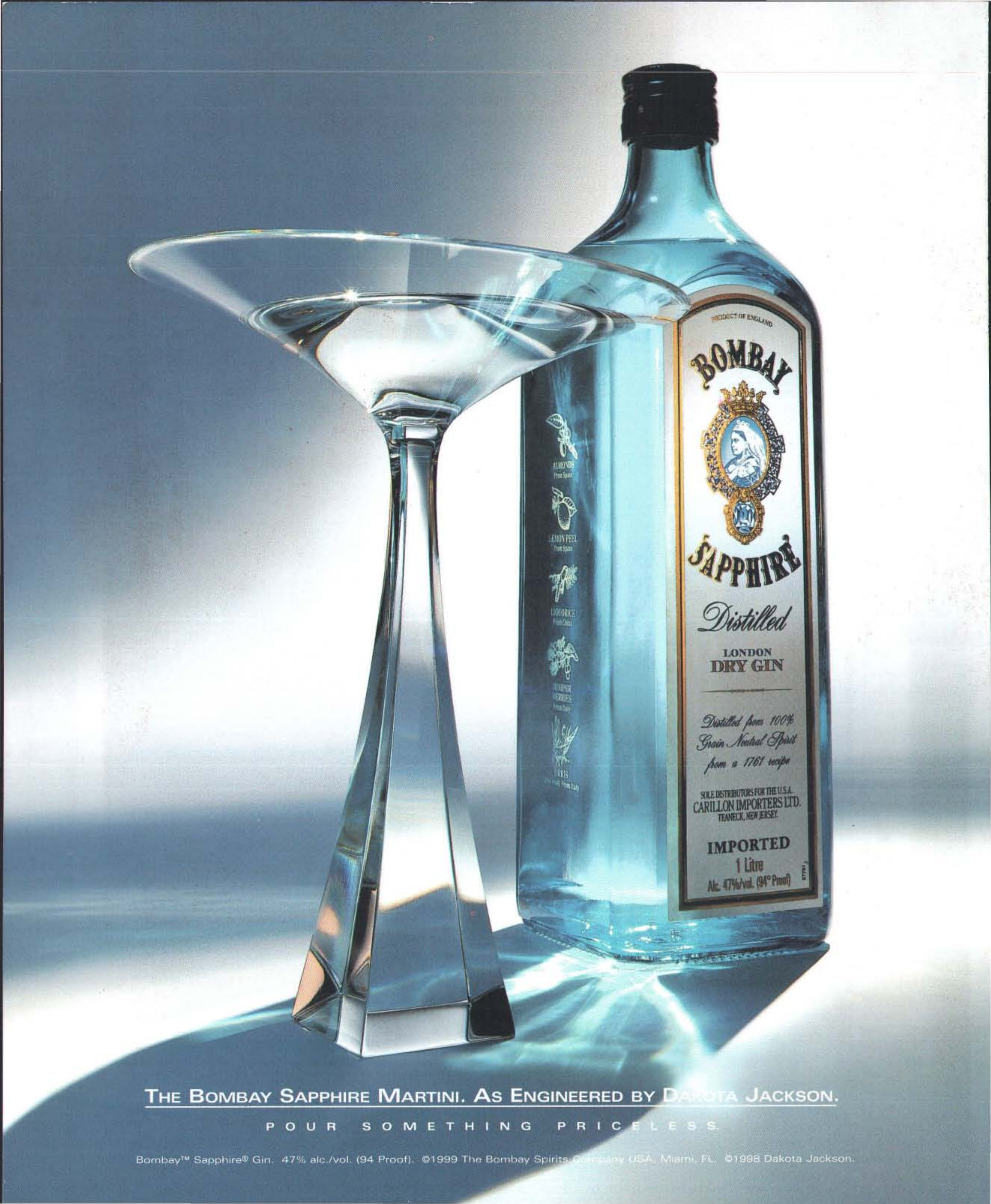
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